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## THE INTERNET, IT'S ALIVE!

The internet of things is something that everyone just can't stop talking about, us included. However, one of the factors that make it so much of a buzzword isn't the fact that your dumb devices are getting smarter, that's just the natural progression of technology.

Instead, we should all understand that our smart devices are dumbing down for us. That's right. Simplicity is the key. In order for the internet of things to be successful, there is a major focus in the industry to ensure that the average user no longer needs extensive tech know-how. Do you really want to re-learn how to use your new connected lightbulb? Devices should be able to detect and communicate with each other and complicated setup procedures are reduced to a single button press.

You get the drift.

However, this opens up a whole new can of worms where the majority of tech users today become complacent to the tech they use. We

trust that our new smart devices should just work and we push the responsibility for security to the companies that make them.

Singapore played host to the inaugural INTERPOL World 2015 in April, bringing to light just how much the internet has broken down borders and that criminals half a world away may just as well be sitting right next to you as far as cyber threats are concerned. It is therefore quite fitting that we chose to focus on the security aspects of the internet of things and mobile trends this issue.

As more and more of the population gets connected; as more devices get wireless; as more data makes its way to the cloud, I believe that we need at least a basic understanding of how technology works in order to safeguard our own data. This is a wake-up call.

**Zachary Chan**  
EDITOR



# CONTENTS

J U N E 2 0 1 5

## THINK

### 41

- THE INTERNET: THREATS EVERYWHERE
- CONNECTIVITY STILL DRIVING CONSUMER ELECTRONICS

## IMPACT

### 49

- DOCTOR SELFIE

## Q&A

### 50

- MANTOSH MALHOTRA, QUALCOMM

### 52

- SERGUEI BELOUSSOV, ACRONIS

### 54

- EUGENE KAPERSKY, KAPERSKY LAB

# 41

THINK

## FEATURES

### 57

- WHAT ACTUALLY MAKES YOUR SMARTPHONE SMART?

### 64

- HWM+HWZ.COM TECH AWARDS 2015 READERS' CHOICE

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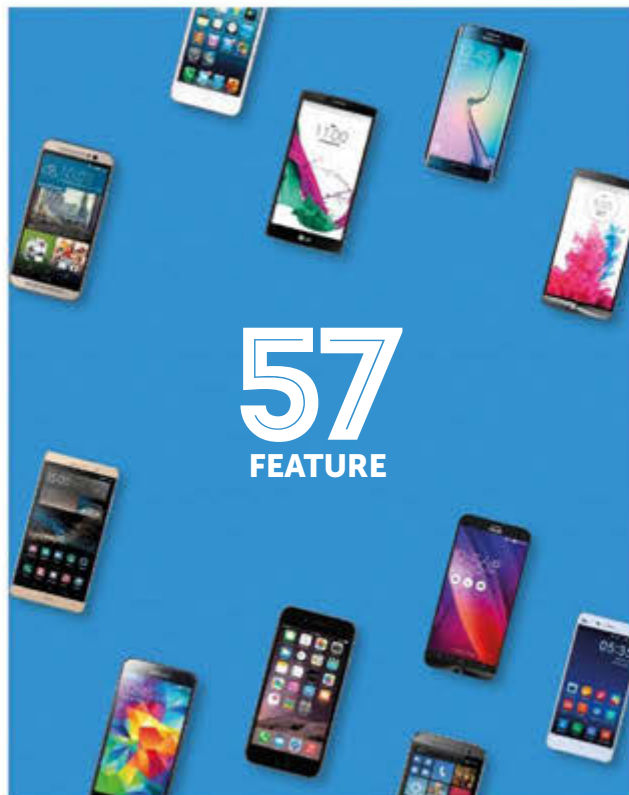


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unless otherwise specified.

## 07 GEAR

Cutting-edge Technology

## 76 TEST

- NVIDIA GEFORCE GTX 960
- ASUS Strix GeForce GTX 960
- Gigabyte GeForce GTX 960 G1 Gaming
- MSI GeForce GTX 960 Gaming 2G

## 84

MECHANICAL GAMING KEYBOARDS

- ASUS Strix Tactic Pro
- Logitech G910 Orion Spark
- Razer BlackWidow Chroma
- Roccat Ryos TKL Pro

## 92

REVIEWS

- ASUS ROG G20AJ
- ASUS Transformer Book T300 Chi
- ASUS ZenFone 2
- Bloodborne
- Casio Oceanus OCW-G1000
- Final Fantasy Type-0 HD
- Fitbit Charge HR
- Fujifilm X-A2
- Seagate Seven
- Philips 65PUT8609 4K TV
- Samsung WAM750
- HTC One M9

## 111

LEARN

- Microsoft Build 2015: The future of Windows
- Shooting better photos with the LG G4
- How to use a chronograph
- In Pursuit of HRA
- App Attack

## 120

REWIND





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# TEE OFF WITH *HER* WORLD

The *Her World* Golf Challenge is here again – and, for the first time, with a wacky theme to celebrate *Her World's* 55th anniversary! Round up your girlfriends, wear your wildest hat, and have a crazy good time. Sign up now and receive an attractive goodie bag worth \$150. You also stand to win fabulous prizes!



Venue: Sentosa Golf Club  
(Tanjong Course)

Date: July 3, 2015 (Friday)

Time: 11am to 9:30pm

Format of play: Double Peoria  
System (Stableford)

Registration fee: \$289  
(includes lunch and dinner)

Early-bird fee: \$249  
(sign up by June 7, 2015)

Programme Line-up:

11am: Registration

11.15am – 12.45pm: Lunch

1pm: Tee-off

6.30pm – 9.30pm: Dinner and prize presentation



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# NEW THIS MONTH

Every month, we receive dozens of product announcements and mentions, sit through many a launch event and try out all kinds of devices. All these products are then carefully curated by our crack team of tech gurus. The final list is presented here in Gear and it is our hope you'll find something to geek-out to.



## MORE INSIDE >

**SEAGATE WIRELESS**  
Universal portable drive.

**JAWBONE UP3**  
Advanced tracking in a prettier package.

**CANON XC10**  
Cute as a button 4K camcorder.

**JABRA BOOST**  
Out talk everyone else.

## GOOGLE CHROMEBOOK PIXEL 2

Google's US\$999 Chromebook Pixel 2 is perhaps the best, as well as the most expensive, Chromebook you can buy. It packs a new Intel Core i5 processor, 8GB of RAM, 32GB SSD, and a 2,560 x 1,700-pixel touchscreen. It also has two USB-C ports. For US\$300 more, there's an LS variant that ships with a faster Core i7 processor, 16GB of RAM, and a 64GB SSD.



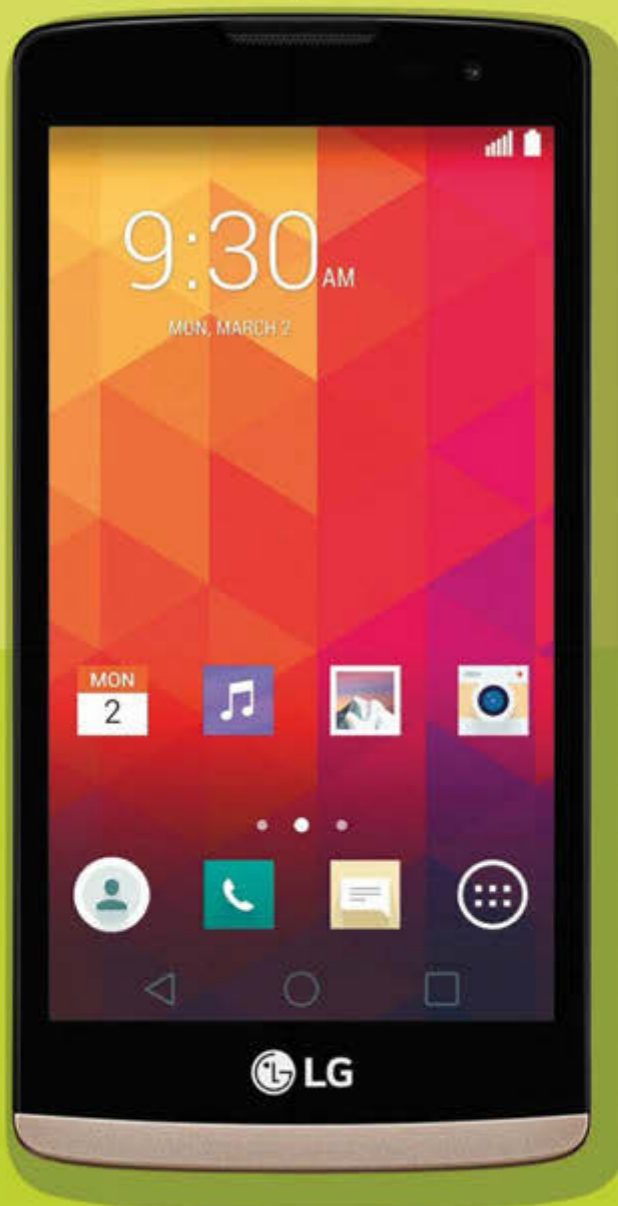
## SEAGATE WIRELESS

If you are always running out of space on your smartphone, then the all new portable Seagate Wireless might be the solution for you. This Wi-Fi enabled mobile storage is designed with a 500GB capacity and allows you to stream your contents, such as large movie files and pictures on-the-go. To top it off, it also provides up to 6 hours of battery life to charge your devices and is available in 5 vibrant colors.



## LG LEON LTE

The wallet-friendly LG Leon sports rear buttons, just like LG's flagship LG G3, and runs on a quad-core Qualcomm Snapdragon 400 processor with 1GB RAM. In addition, the 4.5-inch smartphone boasts a number of features previously only available in LG's premium smartphones such as intuitive UX, in-cell touch display, and Gesture Shot.



## OPPO HA-2

Not only does the Oppo HA-2 feature a hybrid class AB amplifier with a USB DAC that features the ESS Sabre DAC Chip ESS Sabre32 Reference ES9018-K2M, it also comes with a large 3000mAh lithium polymer rechargeable battery that you can use to recharge your mobile devices so you'll always have music everywhere.







## **ASUS TRANSFORMER BOOK T100 CHI**

If you are looking for an affordable and portable 2-in-1 hybrid notebook, ASUS has a treat for you in their new Transformer Book T100 Chi. Featuring a 10.1-inch 1,920 x 1,200 pixels resolution display, the Transformer T100 Chi is powered by a quad-core Intel Atom processor and is just 7.2mm thick and weighs a scant 570g.



## PROLINK FERVOR PRO

The new Fervor Pro features NFC for easy pairing and an internal battery that's good for up to 19 hours. Multi-device pairing lets you move easily from your smartphone to your tablet, while the semi-open over-ear design gives you the perfect balance between comfort and noise isolation. There's a built-in microphone for calls, and the headset continues to operate even if the batteries are low via a regular audio cable.

## JAWBONE UP3

It's taken a long wait, but we should finally see the Jawbone's latest flagship activity tracker hitting our shores later this year. The new Up3 is splash and shower-proof and tracks your activity levels and quality of sleep. The new Up3 also has advanced bioimpedance sensors that track your heart-rate, respiration and galvanic skin response.







## CANON XC10

The Canon XC10 is one of the most compact and versatile digital video camcorders to date designed for 4K video recording. It features a 12.0-megapixel 1.0-inch CMOS sensor, DIGIC DV5 signal processor and a 10x wide-angle zoom lens with optical image stabilization. Along with its compact form, the XC10 supports many mounts and accessories to suit all kinds of shooting scenarios from hand-held to drones.

## JABRA BOOST

If you want to keep talking and talking and talking everywhere you go, you might want to consider the Jabra Boost. This tiny mono Bluetooth headset has enough juice to offer a talk time of up to nine hours, and a Power Nap mode that lets the battery last for up to a year! You know, it'll be one of those things you find during spring cleaning, press the button and go, "Hey, it still works!"



## SONY XPERIA M4

With a weather resistance rating of IP65/IP68, this is one phone you can take into the pool with you. The Xperia M4 features a 5" HD IPS screen, a speedy 64-bit octa-core Qualcomm Snapdragon processor and a 2400mAh battery that gives up to two days of battery life, perfect for that weekend camping trip.







## FUJIFILM XF16MM F1.4 R WR

Fujifilm's new XF16mm F1.4 R WR brings a weather-sealed wide angle lens to the X-series, with nine seals in eight areas on the lens barrel to keep it protected from the elements. The design even absorbs the temperature difference between the internal parts of the lens, allowing it to work as low as -10 degrees Celsius.

CANON SPECIAL



# "IT'S ALL ABOUT THE MEMORIES."

Why James upgraded to a DSLR camera and hasn't looked back. A story about how photographs are more than just megapixels.

To find out more about the Canon EOS 760D and EOS 750D, go to [www.canon.com.sg](http://www.canon.com.sg)





People use their smartphones to take pictures all the time, even for important family occasions. James does that too.

But when his photos of grandma's 80th birthday turned out dark and noisy, he had enough. He knew his best moments deserved more than that.

By chance, James was introduced to Canon's newest EOS 750D and EOS 760D DSLRs by a friend. Agreeing to take the EOS 760D out for a spin turned out to be one of the best decisions he would make.

## CAPTURING 5 FRAMES PER SECOND

James' son Kenny has been getting into sports recently, especially basketball. James used to be quite the basketball player himself, but at his age, he now prefers to shoot pictures instead of hoops.

The problem was that with his smartphone, James couldn't get close enough to get the shots of Kenny playing without interfering with the game. You see, his smartphone couldn't zoom in on the action, not without resorting to a digital zoom that always ended up as a grainy, pixelated mess. It was also hard to capture the right moment since he could never seem to tap fast enough for the phone to respond.

But even right out of the box, the EOS 760D could already get the shots James needed. And with its all cross-type 19-point AF (auto focus), the EOS 760D had no problem locking onto Kenny even when he was moving quickly across the frame. Because the camera could continuously capture five frames per second, James could press and hold the shutter and be sure he'd walk away with amazing action shots.

The best thing was when James tried shooting video. Because the EOS 760D has a feature called Hybrid CMOS AF III, which lets it rapidly track moving subjects in Live View, James could shoot HD video of Kenny running and dodging across the court, while keeping him easily in focus.



With 5fps continuous shooting, the Canon EOS 760D and EOS 750D capture action as it happens

## LIFE-LIKE VIDEO WITH CLEAR SCENES

James discovered that he quite liked shooting video with his EOS 760D. For one thing, it wasn't as tough as he thought it might be; the camera handles everything beautifully in Auto mode. When he needed more control, James liked how he could easily just tap on the screen to change focus without having to dive into clunky menu systems - debunking the misconception that DSLRs were too complicated to use unless you were a pro.

The EOS 760D also solved the one major problem James could never get right with when shooting video on a smartphone, and that involved high contrast scenes, such as indoors against a bright window. A smartphone just isn't sophisticated enough to handle the complex metering in real time. The HDR video mode on the EOS 760D can automatically even out the bright and dark areas, producing a more balanced, life-like video.



Videos shot without HDR end up looking harsh and overexposed.



With HDR video mode, the EOS 760D produces natural looking video in any light.





## SHOOTING INTO THE EVENING

Something James never liked doing was shooting after the sun went down. Whenever the light went dim, his smartphone camera struggled to make pictures that remained sharp; even the tiniest movement would create ugly shadows and smears.

Of course, James needn't have worried. After playing around with the EOS 760D, he discovered that he could increase ISO settings to brighten up the scene, even in the dim evening light. That's because ISO increases the light sensitivity of a camera's sensor, making it easier to capture more light in a scene. And with the advanced high-resolution sensor found on the EOS 760D, increasing ISO wouldn't impact image quality or performance as it would have on his smartphone.

The EOS 760D could shoot from ISO100 all the way to ISO25,600, and at ISO3,200 James found that he could already grab a bright and detailed shot of the night landscape without any additional equipment. It would remain something to remember for years to come.



Amazingly detailed night shots with low noise is achievable on the EOS 760D.



## CAPTURING VIVID DETAIL AND COLOUR

Something James didn't expect was the rich detail and vivid color he got from the EOS 760D. As with many of his friends, he'd gotten used to the quality from a smartphone camera, which always looked great on the smaller screen, but different when viewed on a PC or the living room TV.

So when he took his family out for a picnic and played with photographing the food they'd brought, he was surprised to see how much better his pictures looked: the fruits popped with lifelike color, and the food was captured with minute detail. There was more in the shot than usual, much more, and that came from the EOS 760D's 24.2 MP APS-C CMOS sensor. Not only did the camera capture more detail because of its high megapixel count, its larger sensor allowed it to photograph more accurate color and tonality than smartphones with smaller sensors. Canon's high-quality lenses make full use of the sensor's ability to resolve more detail, and the camera's DIGIC 6 image processor creates the true-to-life colors that Canon is known for.



The EOS 760D can bring even a simple photo to life with a burst of color that's both vivid and life-like.



Every speck of detail is captured with the EOS 760D, which means photos can be blown up on the big screen or printed at high resolution and still look just as good.

## IT'S ALL ABOUT THE PHOTOGRAPH

"I never knew what I was missing until I tried it," James told me. "The only thing I regret is not giving a DSLR a try earlier. It's not just about the fun you can have, playing around with the manual controls that smartphones or digital compacts don't have. The increased detail and color is also nice, but it's not just about that either."

James paused. Then he pulled out his EOS 760D and scrolled through the images on the camera. He stopped at one, and he showed it to me. It was a shot of him and his family, sitting on the green field, enjoying the food from their picnic.

"It's about capturing the memories that I don't want to miss, looking just as real as the way I remember them."



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Whether for work or for home, Fuji Xerox's printers combine print quality with wireless printing for easy productivity.

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### DOCUPRINT P265 DW



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### DOCUPRINT M265 Z



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### DOCUPRINT CP115 W



## THE ADVANCED WORKHORSE

The DocuPrint CM225 fw provides advanced performance with an intuitive interface. This multifunction color printer prints, copies, scans and faxes, and lets you print wirelessly through Wi-Fi, with support for both AirPrint and Google Cloud Print. The CM225 fw prints up to 18 pages per minute, in both color and monochrome, up to a vivid resolution of 1,200 x 2,400dpi. A 4.3" color touchscreen interface makes it easy for you to get things done with the CM225 fw.

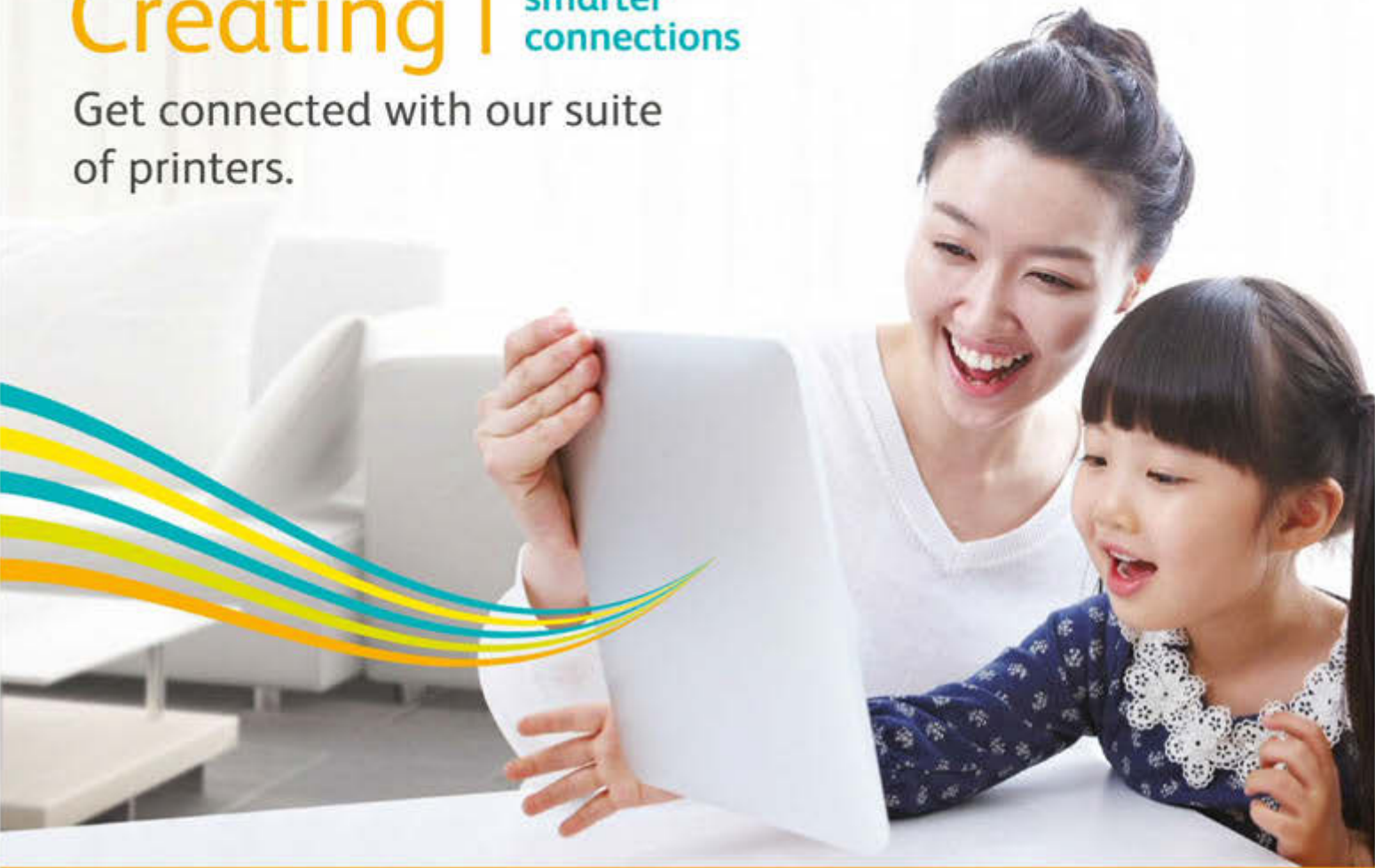
### DOCUPRINT CM225 FW





# Creating | smarter connections

Get connected with our suite of printers.



At Fuji Xerox, we fully support your creation. Big or small. It's the one thing we do and do well here. That's why we're constantly evolving our printers to bring you effortless connectivity, like the new DocuPrint series. Anything you want to create, we make it easier and more efficient for you.

*What are you creating today for tomorrow?*

**NEW**



DocuPrint 225 / 265 series

**NEW**



DocuPrint C115 / C225 series



Discover how our innovative features from the latest DocuPrint series can support what you do seamlessly.

# EVERYDAY SMART GADGETS

From professional tools to security and personal entertainment, PROLiNK's got just the right gadget for you.

## ADVANCED SOUND WITH LUXURIOUS COMFORT

The PROLiNK Fervor Pro has a semi-open design for powerful bass and clear highs without compromising wearing comfort. It connects via Bluetooth 3.0 and supports NFC with multi-device pairing to switch between sources easily. It also features a built-in noise cancelling mic to take calls or execute voice commands on your smartphone. If you don't have a Bluetooth enabled device, it even supports wired connections via an included 3.5mm audio cable.

### PHG9001E FERVOR PRO BT HEADSET



## VIBRANT HEADPHONES FOR A COLORFUL LIFE

The PROLiNK PHB6001E Fervor Basic are trendy, super slim over-ear headphones that come in five vibrant colors – black, blue, pink, grey and white. They are designed to be ultra-light with a flexible headband for an easy fit. Like the Fervor Pro though, the Fervor Basic also supports NFC pairing, multi-device pairing and a built-in noise-cancelling mic. It doesn't support wired connection though.

### PHB6001E FERVOR BASIC SUPER SLIM BT HEADSET



## MONITOR IN ANY CONDITIONS

The PROLiNK PIC1008WN is the only IP camera you'll need for outdoor surveillance due to its weather-proof enclosure. Besides recording in 720p resolution, it features separate lens and image sensors for day and night use, plus adjustable high-powered IR LEDs to further boost night vision performance. Like all PROLiNK IP cameras, you can also expect effortless setup.

### PIC1008WN OUTDOOR WIRELESS IP CAMERA



## THE ELITE LASER POINTER

Laser pointers are a dime a dozen, but the common red laser is not powerful enough to be seen under brightly lit areas. The PROLiNK PWP106G features an advanced green laser that is 3X as bright as regular led lasers. What's more it's a wireless presenter with an effective range of around 30 meters and a battery that can last up to six months of continuous use.

### PWP106G 2.4GHZ WIRELESS PRESENTER WITH GREEN LASER



## SHARE 4G CONNECTIONS

Tired of 3G portable hotspots that do not fully take advantage of your 4G network? The PROLiNK PRT7007L supports 4G LTE data rates up to 150Mbps. It supports dual-band 2.4GHz and 5GHz WiFi with 2T2R MIMO antennas for improved throughput performance for both data and media streaming. What's more, you can share your connection with up to 15 users.

### PRT7007L 4G LTE WIFI HOTSPOT 150MBPS





# PROLINK®

www.prolink2u.com

Your Inspirations. Our Innovations.



## 1 HOT SPOT = MULTIPLE CONNECTIONS

Stay connected all the time whether you're home or away  
with the PROLiNK® PRT7007L



**PRT7007L**

**150Mbps** Portable 4G LTE WiFi Hotspot



### High-Speed Cellular Internet Access

- Enjoy High-Speed internet access on the go with a maximum data transmission rates of up to 150Mbps.

### Equalizer and Receive Diversity

- Achieve maximum network throughput via equalizer and receive diversity.

### Automatic Network Selection (Auto-APN)

- Connect to a GPRS/ EDGE/ HSPA/ HSPA+/ LTE network automatically without any configurations.

### 2T2R MIMO Technology

- 2T2R MIMO Technology delivers greater throughput and performance.

### Multi-user (Up to 15 Users)

- Shares Internet connection with up to 15 users.



### Compatible with:



### System Requirements:

Windows XP/Vista/7/8/8.1, Mac, Linux, Android 2.2 & above, iOS 4.3.3 & above  
\*Support for Intel-based Mac only

Manufactured by **Fida International (S) Pte Ltd.** Email: [sales@fida.com](mailto:sales@fida.com) Tel: +65 6357 0668  
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WEBSITE

# EXTRAORDINARY PERFORMANCE, EXTRAORDINARY ENERGY

Celebrate the 28<sup>th</sup> Southeast Asian Games with GP's Special Edition SEA Games PowerBank, charger and batteries.

## STAY CHARGED WITH NILA

Stay fully charged with Nila, the mascot for the 28<sup>th</sup> SEA Games, silkscreened on the GP PowerBank. The high-capacity PowerBank has a 10,400mAh lithium-ion battery, perfect for charging smart devices. With 2 outputs, the PowerBank can charge two devices at the same time, with a total output of 2.1A. Recharge it quickly via USB from a PC or power adaptor.

### GP POWERBANK



## GO THE EXTRA MILE

The GP Rechargeable AA batteries are ideal for digital cameras and flash. Because they last longer, they provide more savings in your day-to-day life. These high performance batteries also work well in various applications, including for mouse and keyboard, torch and bike lights, toys and gaming accessories, cordless phones and remote controls.

### GP RECHARGEABLE



## GO FOR GREEN

Unlike ordinary alkaline batteries that can only be used once, the GP ReCyko+ batteries can be recharged over 1,000 times. That not only saves you money, it also benefits the environment by reducing waste. Better yet, the ReCyko+ batteries are more powerful than alkaline batteries. The ReCyko+ batteries come pre-charged and stay charged for more than a year in storage.

### GP RECYKO+



## RECHARGE AND CHARGE ON

The GP PowerBank Charger with ReCyko+ batteries give you a powerful all-in-one solution that ensures you'll always be powered on. Charge two to eight batteries, within two to eight hours, with trickle charging to always have fully charged batteries. Leave it to charge safely overnight, with defective and primary battery detection, and use it around the world with universal plugs.

### GP POWERBANK CHARGER WITH RECYKO+



## LONG-LASTING STAMINA

Built with advanced technology, GP Ultra Plus alkaline batteries deliver long-lasting and reliable power for high-performance devices. These are the batteries you call for when you need marathon-level stamina for your devices. The GP Ultra Plus alkaline batteries are available in all popular battery sizes.

### GP ULTRA PLUS







28th SEA  
GAMES

OFFICIAL BATTERY PARTNER

# Powering the games



Alkaline Batteries



Rechargeable Batteries & Charger



PowerBank

Special editions now available in selected retail stores



[www.gpbatteries.com/sg](http://www.gpbatteries.com/sg)

recharge with **GP**

# THUNDER IN A BOTTLE

Thanks to its unique acoustic design, the UB+ Eupho delivers bigger sound than its small size suggests.



## BIG SOUND, SMALL PACKAGE

The Eupho Bluetooth speaker is thunder in a bottle. Thanks to patented ORCHAS™ technology, the speakers reproduce sound with rich detail and foot-thumping bass, in a compact space that fits into the palm of your hand. The Eupho's acoustic structure has been thoughtfully designed to produce music so life-like it's as if you were listening at a live performance. UB+ calls this patented design ORCHAS™, or Orchestrated Acoustic Structure. You'll call it amazing music from a small package.

### UB+ EUPHO BLUETOOTH SPEAKER



## POWER AND ARMOR

This unique Expansion Casing is both a protective case and an innovative way to amplify sound. Install it under the Eupho and enjoy a fuller sound with a wider soundstage and deeper bass, with louder volumes. Flip the case around, and it turns into a protective case for carrying the Eupho around. It's a simple yet powerful solution made possible because of the way Eupho's speaker components are designed to deliver sound.

### UB+ EUPHO EXPANSION CASING



## DOUBLE THE FUN

Eupho has been designed from the start to be infinitely expandable. The upcoming UB+ Eupho Stereo expansion casing combines two Euphos into a stunning stereo speaker system. It has two individual Bluetooth connections to stream music from two different sources, letting you easily share music between friends at gatherings. The casing comes with a refined wooden finish, and because the Eupho is portable, so is the Stereo case.

### UB+ EUPHO STEREO



## FROM PORTABLE TO HOME ENTERTAINMENT

The UB+ Eupho Brave transforms six Euphos into a home entertainment system with six individual Bluetooth connections to easily share music at parties. Traveling somewhere? Just remove one Eupho from the casing and you have an awesome portable speaker to take with you. Once you're home, just insert it back in to for an immersive, powerhouse audio experience. The Eupho Brave casing comes in a beautiful wooden finish that fits in with any home.

### UB+ EUPHO BRAVE

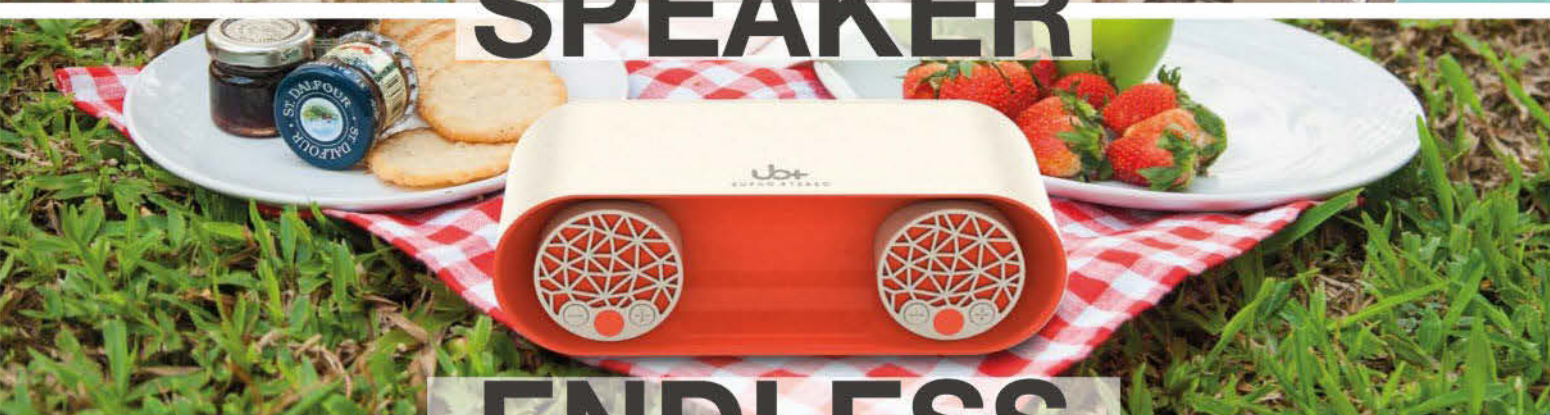




# ONE



# SPEAKER



# ENDLESS



 **Bluetooth™**

ACHIEVE MULTIPLE  
BLUETOOTH CONNECTIONS  
ON A SINGLE PRODUCT  
WITH UB+ EUPHO STEREO  
AND UB+ EUPHO BRAVE

# POSSIBILITIES

Solve the dilemma between big and small speakers with the award-winning **UB+ Eupho Modular Speaker**. Use **UB+ Eupho** on its own or combine them with different expansion casings to suit different needs and scenarios. Achieve unbelievable sound quality and endless expansion possibilities beyond size, anytime, anywhere. This is how speakers should be used.

**ORCHAS™**

PATENTED TECHNOLOGY FOR  
AWESOME SOUND QUALITY AND  
EXPANSION CAPABILITY

**BuddyStereo™**

CREATE STUNNING STEREO  
EFFECT AND AN IMPRESSIVE  
SOUNDSTAGE

**20**

HOURS  
BLUETOOTH  
PLAYBACK  
TIME



SINGAPORE  
GOLD  
DESIGN



COMPUTEX  
ASIA 2016



SINGAPORE 2015  
DESIGN AWARD

**ub+**

MODULAR  
SPEAKER

ub-plus.com |  @ubplussg  /ubplussg



# TAKE AMAZING SOUND WITH YOU

Philips' expertise in sound design brings you clear, natural sound, wherever you will go.



## POWERFUL BASS IN A LIGHTWEIGHT DESIGN

Enjoy incredible bass in a lightweight, foldable design. The Philips FX5 headphones are built with 40mm neodymium drivers that deliver rich bass and powerful sound, with adjustable bass boost control for your personal listening preferences. Noise isolating around-ear cushions provide long-wearing comfort, and the headphones fold into a compact size for easy storage and portability. Control your music and take calls easily with the in-line remote with microphone.

**FX5MBK (BLACK)/FX5MWT (WHITE)**



## RUGGED ROAD ACOUSTICS

Listen to your tunes loud and clear even in the rugged outdoors with the Philips Shoqbox. This rugged portable speaker is both splash and drop-proof, travel rough and tumble and it keeps on playing. The Shoqbox is also highly versatile, pair two of them into stereo speakers, stream music via Bluetooth®, swipe over the motion sensor to skip songs, and take calls using the built-in microphone. Voice prompts, available in multiple languages, give you useful feedback on battery levels and alerts.

**PHILIPS SHOQBOX SB7200 (BLACK)/SB7210 (WHITE)/SB7220 (GREEN)**



## PEERLESS SOUND AND QUALITY MATERIALS

The Philips Fidelio wireless speaker wraps peerless sound quality in a portable design. Soft dome tweeters provide wide and natural sound, and woofers with wOox technology deliver solid, amazingly deep bass. The optimized crossover filter produce clear and natural sound that is neither aggressive nor tiring, so you can listen comfortably for hours on end. Stream wirelessly via Bluetooth®, and enjoy the premium design of natural wood and aluminum, with an integrated leather cover for protection when on the go.

**PHILIPS P9BLK (BLACK)/P9WHT (WHITE)/P9SLV (SILVER)**



## ENJOY SMART SIMPLICITY

The Philips XL490 Cordless Phone has been designed to be smartly simple and comfortable to use. The extra-large 1.9" high-contrast display makes it easy to see call details, with keypad backlight for quick access even in dark rooms. A one-touch volume boost provides extra loud sound, and the XL490 is hearing aid compatible, with the ability to reduce unwanted noise. The handset speakerphone allows you to enjoy calls hands-free. The XL490 manages up to 16 hours of talk time on a single charge.

**PHILIPS XL490 CORDLESS PHONE**



# Award Winning Philips Fidelio Masterpieces



Award Winning Surround on Demand Series just got even better with the new Fidelio B5 Soundbar Speaker with Stand-alone portable wireless speakers



## Surround on Demand

Submerge your listening senses in superb Dolby Digital 5.1, DTS Digital surround sound whenever you want it. Simply detach the wireless surround speakers from the main speaker unit and place them at the rear of the room to enjoy an immersive movie and gaming experience.

## Stand-alone Portable Bluetooth® Speakers

With two rear detachable speakers and a central sound bar unit, a single Fidelio B5 unit can bring music to three different places at the same time.

## Advanced Spatial Calibration Function

Ensures optimum sound balance, regardless of rear speakers placement in a room.

**NEW**



**Bluetooth**

### Philips Fidelio M2L

Headphone with lightning connector  
*Ideal for iOS device lovers*

**COMING SOON**



The M2L headphones deliver Fidelio's signature sound in high resolution on your iOS device, without distortion or crosstalk, thanks to a lightning connector and built-in DAC. Enjoy pristinely detailed sound anywhere, in style.

### Philips Fidelio NC1

Noise cancelling headphone  
*Ideal for frequent travellers*

**NEW**



Enjoy superior noise cancellation with the Fidelio NC1. All you get is uncompromised high fidelity sound without the noise. Compact foldability and long-wearing comfort make it the best sound companion for long haul or daily commutes.

### Philips Fidelio M2BT

Wireless bluetooth headphone  
*Ideal for wireless listening experience*

**NEW**



At home or on the go, high definition sound and seamless Bluetooth® connectivity is all yours with the Fidelio M2BT. NFC technology ensures one-tap wireless pairing plus intuitive controls let you switch easily between music and calls.

Check in-store for more information

### Philips Consumer Care:

620A Lorong 1, Toa Payoh  
TP4 Building, Level 1  
Singapore 319762

Consumer Care Hotline: (+65) 6737 3000 (Home Audio/Video Entertainment)  
(+65) 6735 9100 (DECT, Headsets and Earphones)



Like us on Philips Sound for latest news and product update

**PHILIPS**



### LOW-COST ACTION

Available in China, the Yi Action Camera is a GoPro-like, point-of-view camera that sells for under US\$100. It packs a 16MP Sony Exmor R backside-illuminated CMOS sensor, has a 155° wide-angle lens with an F2.8 large aperture, and an Ambarella A7LS image processor. With an optional waterproof case, it can go into water for as deep as 40 meters. **Yi Action Camera**



### LIGHTNING-FAST FILE TRANSFERS

A good motherboard just got better. The Asus Z97 Deluxe/USB 3.1 combines a sleek black-and-gold color scheme with integrated USB 3.1 support, effectively doubling the data rate of USB 3.0 to up to 10Gbps. Asus' own USB 3.1 Boost technology pushes the envelope further with sequential read/write speeds of up to 854.6/863.9 MBps, ensuring that you'll be able to transfer your favorite high-definition movie more snappily than ever. **Asus Z97 Deluxe/USB 3.1**



### 32-BIT TRANSFORMING

The Optimus Prime Playstation is the companion piece to the Mega Drive Megatron we featured last issues. Although we figured an SNES might've made a better choice, we still like what Tomy Takara has done with Prime. Not only does he look like a Sony Playstation when transformed, he also comes with a classic Playstation controller and memory card. Sadly, it still is just an action figure. **Optimus Prime Playstation**



### MOST AFFORDABLE WINDOWS PHONE TO DATE

The Lumia 430 Dual SIM is the latest addition to Microsoft's affordable range of Lumia smartphones. Running Windows Phone 8.1, the Lumia 430 is powered by a dual-core 1.2GHz Qualcomm Snapdragon 200 processor, and comes with Microsoft Office, Skype and OneDrive pre-installed. At US\$70, it's also the most affordable Lumia so far that will be able to upgrade to Windows 10. **Microsoft Lumia 430 Dual SIM**

### TINY WONDER

The Wondercube is a tiny keychain device that's just one cubic inch in size, but has everything you need for your smartphone: charging cable, a microSD card reader and/or flash drive, an LED torch and, with a hidden 9V snap adapter, an emergency source of power. It even doubles up as a phone stand! Available in Lightning and micro-USB variations. **Wondercube**

### BUILT FOR PRECISION

Built with acoustic precision in mind, the Zoro II HD uses Noontec's exclusive Surround Closed Cavity Body acoustic technology and Votrik HD400 40mm drivers for better balance between treble, mid-range and bass. **Noontec ZORO II HD On Ear Stereo Hi-Fi Headphones**



### PRINT YOUR BREAKFAST

Make breakfast more exciting with the PancakeBot, which uses a proprietary batter dispensing system to "print" pancakes in any shape you can think of directly onto the included griddle. All you need to do is upload any image to the PancakeBot software, save the design onto an SD card, pop it in the machine, fill it with batter, and watch as it creates breakfast magic. **PancakeBot**

### PHONES WITH PERSONALITIES

The LG Aka is a 5-inch smartphone powered by a 1.2GHz quad-core processor, and comes with an 8MP rear camera equipped with LG's laser autofocus tech. Available in four different "characters", each having its own set of wallpapers, widgets, and ringtones, they can be further customized through stickers, markers, or paint. **LG Aka**

## GET CONNECTED

If you are using a smaller 13-inch notebook, chances are your device comes only with two USB 3.0 ports which may not be enough for your needs. Expand the number of USB ports of your device with the Targus ACH124AP 4-port USB 3.0 hub. Small and compact, the Targus ACH124AP USB hub features four USB 3.0 ports and draws power from your notebook, making it ideal for travel and users who are constantly on the move. **Targus ACH124AP USB 3.0 4-Port Hub.**



## SEE WHAT I HEAR

Sennheiser is expanding its successful Momentum range into an in-ear model, aptly named the Momentum In-Ear. It features Sennheiser's proprietary transducer technology for powerful bass and detailed vocals, all wrapped up in a pretty stainless steel case with mirror chrome detailing. **Sennheiser Momentum In-Ear**

## PC-LESS PRINTING

The new X4300 series from Samsung make one hell of an office workhorse. These new A3 color multi-function printers (MFP) are equipped with a 1GHz dual-core CPU, dual-scan automatic document feeder technology and a smart office ecosystem. You won't even need to be connected to a PC or server to print either. It features a 10.1-inch full touchscreen panel to search and print directly from web browsers, emails or images. You can even preview documents, annotate and edit directly from the printer itself. **Samsung X4300LX**



## BEST-IN-CLASS PROTECTION

The Otterbox Defender series has now been extended for for the Galaxy S6. This ultra-rugged case consists of a two-piece internal polycarbonate shell and external synthetic rubber slipcover to serves as a formidable shock absorber. Not convinced that the phone's Gorilla Glass 4 screen is hardy enough? It even comes with a built-in screen protector for the kiasu in you. **Otterbox Defender for Galaxy S6**



## SOLID SPEED DRIVE

The HyperX Predator PCIe SSD is Kingston's solution to the constraints of the SATA 6Gbps interface. The Predator fits into an M.2 2280 slot and is one of the few M.2 drives available that claims to fully utilize a PCIe 2.0 x4 interface. Its 1,400MB/s read and 1,000MB/s write speeds make it a must-have for power users demanding ultra-responsiveness from their systems. It is currently available in 240GB and 480GB capacities. **Kingston HyperX Predator**



## TAKE TO THE SKIES

Breathtaking aerial videos don't have to be a pipedream anymore for those of us that don't own our own private helicopter. The DJI Phantom 3 Professional allows you to shoot 4K video at up to 30fps – all in a package that fits into your backpack. The Phantom 3 features a 12MP camera with a 94° field of view, distortion-free lens, and a 1/2.3-inch sensor. To cap it all off, you can send it on aerial romps up to 2km away and stream HD video back with Lightbridge technology. **DJI Phantom 3 Professional**



## GOLDEN SPEEDSTER

The GTX 980 20th Anniversary Gold Edition is the fastest GTX 980 card from the company's arsenal. With a base clock speed of 1,317MHz (1,431MHz boost clock), the card leverages on its 14-phase Digi+ power delivery system for stability and performance. It also boasts of a customized PCB to accommodate Super Power Alloy VRM components that include Japanese-made 10K black caps. **ASUS GTX 980 20th Anniversary Gold Edition**



## BRIK BY BRIK

Who can forget the wonderful customizability of LEGO? The Brik Case consists of a piece of solid, snap-on plastic that is compatible with a range of toy brick manufacturers, including LEGO, Mega Bloks, PixelBlocks, KRE-O and K'NEX Bricks. Built for your Macbook, the Brik Case allows you to indulge your inner child in creating an endless variety of designs and patterns using toy bricks. Now, you can assemble the Death Star and wear your heart on your sleeve, or more specifically, your laptop cover. **Brik Case**

### COOLING AT YOUR FINGERTIPS

The Thermaltake Commander FT is a 5.5-inch touchscreen fan controller that fit into a spare 5.25-inch drive bay of your desktop PC. It claims to have the largest touchscreen among all. The operating speeds, of up to 5 cooling fans, can be adjusted with a virtual slider. It can also display a comprehensive amount of information that includes the system's temperature. This is courtesy of its built-in temperature probe. **Thermaltake Commander FT**



### CAR AUDIO ON YOUR HEAD?

Unlike most wireless headphones, the BeoPlay H8 is incredibly slim and lightweight, measuring just 40mm thin and weighing only 255g. Add to that active noise canceling, a 14-hour battery life, and a luxe finish thanks to the use of premium materials like anodized aluminum, cowhide leather plus smooth lambskin and you get one nice set of headphones. **B & O Play Beoplay H8**



### GOING 4K

Riding on the success of its predecessor, the new Canon Cinema EOS C300 Mark II is now upgraded with impressive new features such as dual DIGIC DV5 processors, an 8.85-megapixel CMOS images sensor and support for XF-AVC format for 4K video production. **Canon Cinema EOS C300 Mark II**



### ACCESSORIZE YOUR IPHONE

A phone case is a phone case is a phone case right? What if you could add more functions to a case, functions the phone itself doesn't provide? The Moscase for the iPhone 6 or 6 Plus has switchable backplates that run the gamut from adding in an extra speaker to an e-ink screen for reading. The coolness doesn't come cheap though, as each case is US\$219, not including extra backplates. **Moscase**

### COOL, QUIET AND CONVENIENT

The EVGA GeForce GTX 980 Hybrid features an all-in-one water-cooling loop to deliver dedicated cooling to the GM204 Maxwell-based GPU. The VRM and memory components are cooled separately by NVIDIA's reference blower-style cooler, effectively maximizing heat dissipation for the GPU and delivering more efficient cooling for other critical components. The 120mm radiator and sleek black sleeved tubing make for a fuss-free, elegant cooling solution that will deliver a cooler and quieter experience for all NVIDIA GeForce GTX 980 reference card owners. **EVGA GeForce GTX 980 Hybrid**



### TOUGH UNDERWATER

Underwater lovers! You will be thrilled to know that the Olympus Stylus Tough TG-4 compact camera features new enhancements, such as underwater high dynamic range (UW HDR) and RAW file recording. Additionally, the TG-4 is now equipped with an improved variable macro system (VMS) and F2.0 zoom lens that will help you capture little critters and marine life underwater. **Olympus Stylus Tough TG-4**

## SAME JAVA, MORE STYLE

Coffee enthusiasts can now enjoy a cup of coffee in style with the new limited MINI edition of the Nescafe Dolce Gusto. Incorporating the iconic MINI logo, monochrome colours and sleek curves - the MINI limited edition comes with its signature custom control level, scroll wheel and 15 bar-pump pressure to deliver that perfect crema on top of your coffee.

**Nescafe Dolce Gusto MINI Edition**



### WORLD'S LIGHTEST

Weighing a mere 320g (without cables), the Oppo PM-3 has just laid claim to the title of "World's lightest closed back Planar Magnetic headphones", which really just means great sound in an extremely portable package.

**Oppo PM-3**





# SHAPE RUN'15

S I N G A P O R E

*Singapore's first all-women's run is back – with more race categories! Challenge yourself with the new 15km race or join the Family Run.*

**DATE** JULY 26, 2015, SUNDAY

**VENUE** KALLANG PRACTICE TRACK

**TIME** 6AM

CATEGORY	PAST RUNNER		EARLY BIRD March 18-May 31		STANDARD June 1-19	
	Individual	Buddies (two people)	Individual	Buddies (two people)	Individual	Buddies (two people)
<b>NEW!</b> 15KM	\$49	\$89	\$59	\$99	\$65	\$119
10KM	\$45	\$79	\$49	\$89	\$59	\$99
5KM	\$35	\$59	\$39	\$69	\$49	\$79
<b>NEW!</b> 1.8KM Family Fun Run (two/three/four people)	---	---	\$39/\$59/\$78	---	\$49/\$69/\$88	---

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SPHmagazines

THINK

# THE THREATS AROUND EVERY CORNER

■ The internet landscape has changed, and as we move to the age of connected devices and information sharing, so too have threats evolved.

Text by *Koh Wanzi and Marcus Wong*

Art Direction by *Ken Koh* and Illustration by *Ven*



## MORE INSIDE >

### SERGUEI BELOUSSOV TALKS CLOUD

The CEO of Acronis speaks to our reporter on why he thinks Cloud isn't just the future, but it's actually more secure in the long run, and will help prevent digital obsolescence.

### WHAT KEEPS EUGENE KAPERSKY AWAKE AT NIGHT?

For the founder of Kaspersky Labs, the digital things that go bump in the night are evolving from simple viruses to global connected threats, and everyone has the responsibility to stay vigilant.

# EVERYONE'S PHISHING IN THE CLOUD

Like it or not, the security of your information is longer in your hands.

Whether you like it or not, we're living in a new world. And in this new world everyone from individuals to corporations is plugged into the great big grid of networked computing we call the Cloud.

Resources that were once exclusively bought and maintained by large corporations are now being made available on a pay-as-you-use basis by third party providers, meaning that not only do companies no longer need to have their own technical resources; employees also no longer have to be in the "office" to access them.

After all, why pay for a building to house staff when your staff could just as easily be working from their homes? For that matter, why have an overseas branch when you could just have employees working in their native countries? Remote computing is the new paradigm for the business world, and that means all sorts of data is increasingly becoming available everywhere.

That's something that hasn't been lost on cyber criminals either. After all, why spend the time and effort to hit ten companies when you can hit the Cloud service provider that holds all their data? That's why security is likely to become the number one priority – and differentiating factor – for Cloud service providers like Amazon, Google and Microsoft.

This also means that soon everything that's connected to the Cloud in one way or another becomes a battleground on which Cloud service providers and their security teams try to outdo each other and hackers in discovering and fixing (or exploiting) vulnerabilities.

Can we trust these agencies to be altruistic in reporting their findings? After all, Google's 'Project Zero' has already famously drawn the ire of Microsoft for posting about a vulnerability in Windows 8.1 before they were able to issue a relevant patch, and yet the 'Project Zero' team doesn't seem like they'll be changing their modus operandi anytime soon.

Either way, it seems the capabilities of the respective Computer Emergency Response Teams will very much be the key differentiating factor between Cloud service providers as more and more of our essential services move online. The war for our information is looming, so it's imperative we pick wisely to ensure our information isn't lost in the crossfire.





# BIG DATA IS BIG BUSINESS

Everyone is a target when all your information holds value.

Forget Bitcoin. The true currency of the internet has and always will be data. And with more and more government and commercial organizations tapping into the Cloud to share data and resources, the stream of information that becomes Big Data simply grows exponentially everyday. Which means the value of Big Data is increasing every day.

In fact, Microsoft estimates that governmental organizations taking advantage of Big Data have the potential to raise additional revenue of about US\$206 billion, while financial service institutions and related companies have the potential to gain more than US\$308 billion in value just from data alone. NEC estimates that by 2020 there will be about 8 billion people in the world, and about 50 billion connected devices, all sharing information with and about each other.

So the value of Big Data is certainly becoming more evident to all - including criminals. Indeed, what security agencies like Interpol, Kaspersky Lab and Microsoft's Digital Crimes Unit are finding is that hackers and your traditional "real world" crime organizations are increasingly starting to work together. So much so, that they contend that there's no such thing as "cyber crime" anymore; just "crime".

Traditional crime organizations might hire hackers to steal enterprise information so they can blackmail a particular company for example, while hackers might hire street thugs to collect cash spat out by ATM machines after they've hacked a bank's network. The obvious synergy for these two groups may perhaps be best seen in a recent attack on a shipping port in Amsterdam, where criminals used hackers to take over the port's systems and used it to load heroin onto ships bound for safe destinations of their choosing.

So, with Big Data becoming more and more valued, it's only obvious that this will be the next hunting ground for criminals. After all, connected devices are everywhere, and data is being collected from every single one of them. That fancy new smartwatch is just another opening to the server it sends data back to. And why try to hack a bank server's security when you can just take over the banking app on the unsecured mobile phone of one of its customers?

While securing the Cloud is a task that falls mainly on the shoulders of the organizations that build, maintain and run the multitude of servers that enable the Cloud as we know it, it does seem that perhaps the responsibility to ensure that the security of Big Data is maintained will fall on every single one of us.

# THE INTERNET OF THREATS

In an age when even our devices are getting social, everything connected is at risk.

■ We usually think of social networking as comprising mainly of people. Networks like Facebook, Twitter and LinkedIn exist primarily to connect people to each other. But social networking is gradually expanding beyond people to include a network of applications, devices and products. The Internet of Things (IoT) is fast becoming an integral aspect of new social networking trends, but these emerging networks of people, apps and devices bring with them their own share of security risks.

For instance, Devin Redmond, vice-president and general manager of Proofpoint's Nexgate division notes that "Company-affiliated social pages, profiles and accounts are the next big attack surfaces for fraud, phishing, hacking and data theft." Nexgate's 2014 report on security threats to the social infrastructure of Fortune 100 companies found that the primary purpose of social media threats was to steal customer data, damage the brand, manipulate markets and perpetrate various internet scams.

Cyber criminals will target platforms where people congregate, and social media platforms open up lucrative opportunities for them to exploit. Symantec's 2015 Internet Security Threat Report cited an increase in manual sharing scams, where people voluntarily and unknowingly shared videos, stories or pictures that included links to malicious sites. Social networks provide fertile ground for these sharing scams, and attackers only have to plant to seed and let the network do the rest of the work. They take advantage of the power of "social proof", where people tend to attribute more value to something that has been shared or approved by others.

Similarly, IoT devices are equally vulnerable to attacks by cyber criminals. The IoT comprises social networks of connected devices that span a diverse range and are subject to an equally vast variety of threats. For example, the surge of wearable devices poses security and privacy threats to its users. In a review of the 100 health apps in the Apple App Store, it was found that 20% transmitted unencrypted user credentials and 52% did not have any privacy policies. Users risk exposure of personal data from health-monitoring devices, and could even be tracked without their knowledge via intercepted location data.

More than ever, there is a need for greater awareness of measures to secure social media infrastructures – encompassing user accounts, applications and devices – and more robust solutions to protect data and fend off attackers. In Eugene Kaspersky's words, "The IoT is the Internet of threats for us." It's time we sat up and took notice in order to reap the benefits of social media and connected devices while neutralizing potential threats.

# MOBILITY IS A DOUBLE-EDGED SWORD

With greater flexibility comes a greater set of concerns.

■ The threat landscape is shifting around us. Mobile trends are on the rise, opening up a world of opportunities for consumers and businesses alike. But it's not all a bed of roses, and today we're experiencing a revolution of cyber threats that have mobile devices squarely in their crosshairs. As Mark Bermingham, Global Director of Product Marketing at Kaspersky Lab aptly puts it, "As consumers and businesses shift to using mobile devices for a greater percentage of their daily activities, cyber criminals will place a larger emphasis on targeting these platforms – specifically Android and jail-broken iOS devices."

Mobile security company Lookout found a staggering 75% increase in Android mobile malware encounter rates in the US compared to 2013. The rise of mobile devices in the workplace and the growing popularity of Bring Your Own Device (BYOD) programs have also exposed companies to multiple points of vulnerabilities. A single infected device can compromise an entire network, making it more important than ever for enterprises to implement solutions that will be able to protect company and employee data both in and out of the office.

Companies who have embraced the additional flexibility of mobile devices will need more robust solutions to secure communications from a plethora of devices, data, and file syncing and sharing. Blackberry, formerly the go-to device for secure mobile devices for businesses, is looking to reclaim its position in the security landscape by acquiring document security firm WatchDox. Recognizing that enterprises need secure mobile solutions to enable employees to collaborate more effectively, Blackberry now aims to unite WatchDox's data-centric security with its user-friendly experience to create a comprehensive mobility solution for today's organizations.

And it's not just data that's at risk. The proliferation of mobile payment solutions like Apple Pay, Google Wallet and Samsung Pay potentially expose millions of customers, banks and retailers to payment



fraud. Google Wallet suffered from revelations that unauthorized users could gain access to funds in the account, which forced Google to temporarily disable provisioning of prepaid cards while it worked to fix the issue. Cyber criminals have continually targeted vital data like credit card information – US retail giant Kmart last year admitted to a breach in its payment systems – and the growth of mobile payment systems represent fertile ground for hackers to exploit.

Last year, the number of mobile devices officially surpassed the number of people on the globe according to GSMA Intelligence's real-time tracker. There is no holding back the mobile age and it's up to enterprises, security companies and consumers to do exercise due diligence and take the necessary steps to hold back the tide of opportunistic cyber criminals.





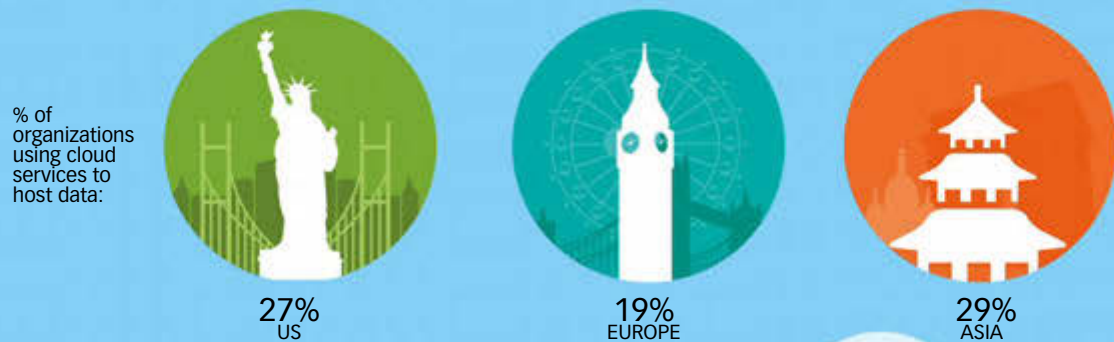
INFOGRAPHIC:

# THE NEW THREAT LANDSCAPE

Breaking down the threats in today's connected world.

by Koh Wanzi & Marcus Wong

## More and more of our service providers are turning to the Cloud

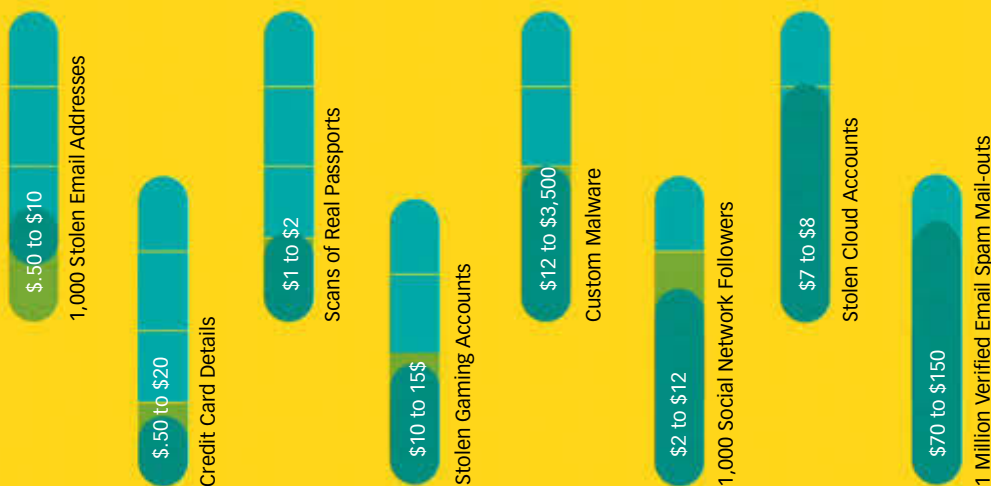


## How much is that data worth?



Source: 2011 Advanced Micro Devices report

## Crime as a service. How much is your data worth?



Source: Symantec, 2015 Internet Security Threat Report, Volume 20

## Forms of attacks on the Internet of Everything



**Sniffer Attacks**  
'Sniffer' program steals unencrypted information passed through a network



**Denial of Service**  
Cybercriminals prevent or slow down the use of certain networks and devices



**Compromised-Key Attacks**  
The key to encrypted communications is stolen and used to interpret the data.



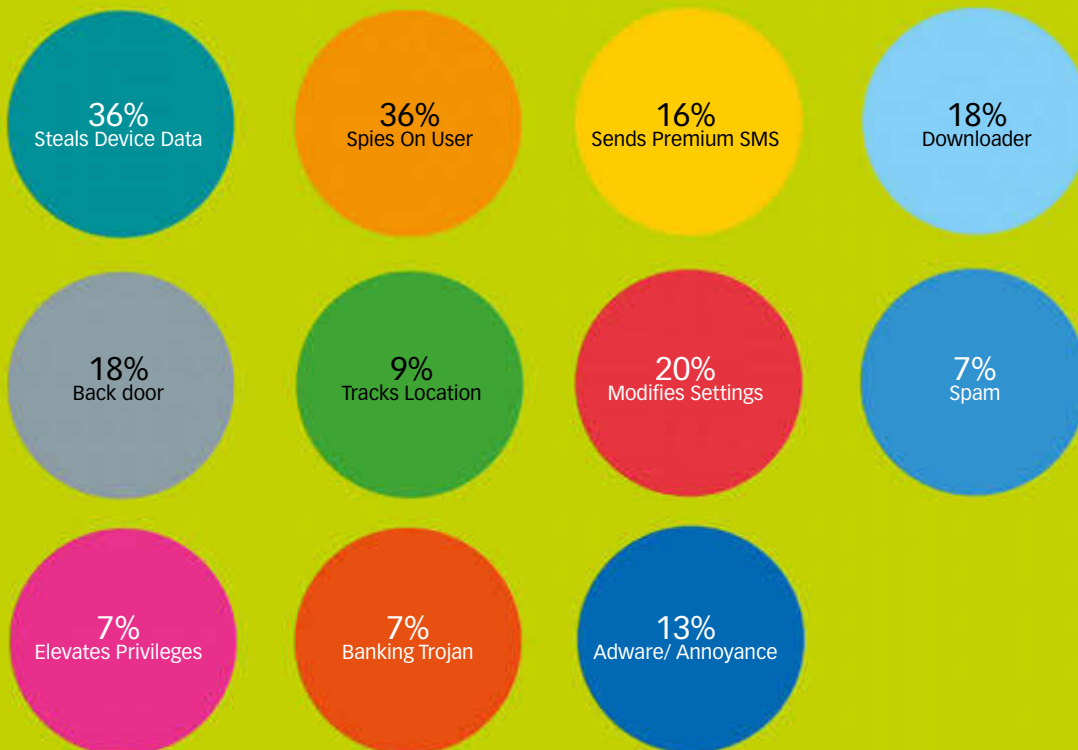
**Password-based**  
Cybercriminals break into a network or device connected to a specific network by guessing or stealing its password



**Man-in-the-middle**  
Third-party steals data being transmitted between two parties or devices.

Source: Trend Micro

## Detailed Threat Categories for Mobile Apps 2014



Source: Symantec 2015 Internet Security Threat Report (Vol. 20)



# CONNECTIVITY DRIVING CONSUMER ELECTRONICS

Otherwise known as, one smartphone to rule them all.

by Zachary Chan

Messe Berlin, the organizers of IFA in Berlin, normally holds a pre-show press conference to talk about the changing trends of the consumer electronics market in Europe as well as the world. This year, the IFA GPC was held in Malta, and the key takeaway was that connectivity will remain the main driver for innovation in the industry for 2015 and well into 2016.

Analysts from GfK showed that sales of mobile internet devices will continue to grow worldwide. In 2010, 59 million smartphones were sold across the APAC region. In 2014, this number rose astronomically to 625 million units. Everyone wants a piece of this pie. In 2010, there were 16 smartphone brands. In 2014, there were 90.

GfK estimates China alone will account for almost as much as all of North America and Europe combined with 408 million smartphones sold in 2015. This is in contrast to North America with 198 million, Western Europe with 140 million and Central/Eastern Europe with 83 million for a total of 421 million. And to cement a trend we know has been coming, tablet sales have basically stagnated for the past two years and are estimated to decline this year.

What's interesting though is that while GfK's numbers show a demand for mobile internet devices, the overall picture isn't quite so rosy. If we were to zoom back in on the APAC market reports, comparing year-to-date 2014 with 2013, every category saw a

*"It is the changing of consumer behavior, driven by increased connectivity that's influencing spending."*

decline. Consumer electronics was down by 7% to 30 billion USD, Information Technology was down by 7% to 80 billion USD, camera and photography saw the largest decline of 20% and is also the smallest industry valued at 8 billion USD. The only category that didn't record a loss - no surprise to anyone - was telecommunications, valued at 158 billion USD. However, it didn't record a growth either; the market was flat.

While there are definite factors that contributed to this decline over the past two years such as market saturation and price erosion, it is the changing of consumer behavior, driven by increased connectivity that's influencing spending. What we're really seeing is that as other industries shrink, the smartphone steps in to fill that gap. Or if you look at it from another perspective, as the smartphone takes

over the capabilities of yet another dedicated device, that industry starts to shrink.

Social networking, photo, video, music, travel, news, productivity, navigation, shopping, healthcare, fitness...you name it and the smartphone is at the heart of it all.

So yes, connectivity now drives innovation in every category, not just in consumer electronics but also domestic appliances. Every new smart product shouldn't just be able to connect to the internet or offer online services, they should be driven by apps and connected to an expanded ecosystem and by that, we mean your smartphone.



# DOCTOR SELFIE

by Koh Wanzi

**New research from scientists at the Massachusetts General Hospital suggests that smartphones could potentially be used as an early diagnostic tool for diseases like cervical cancer.**

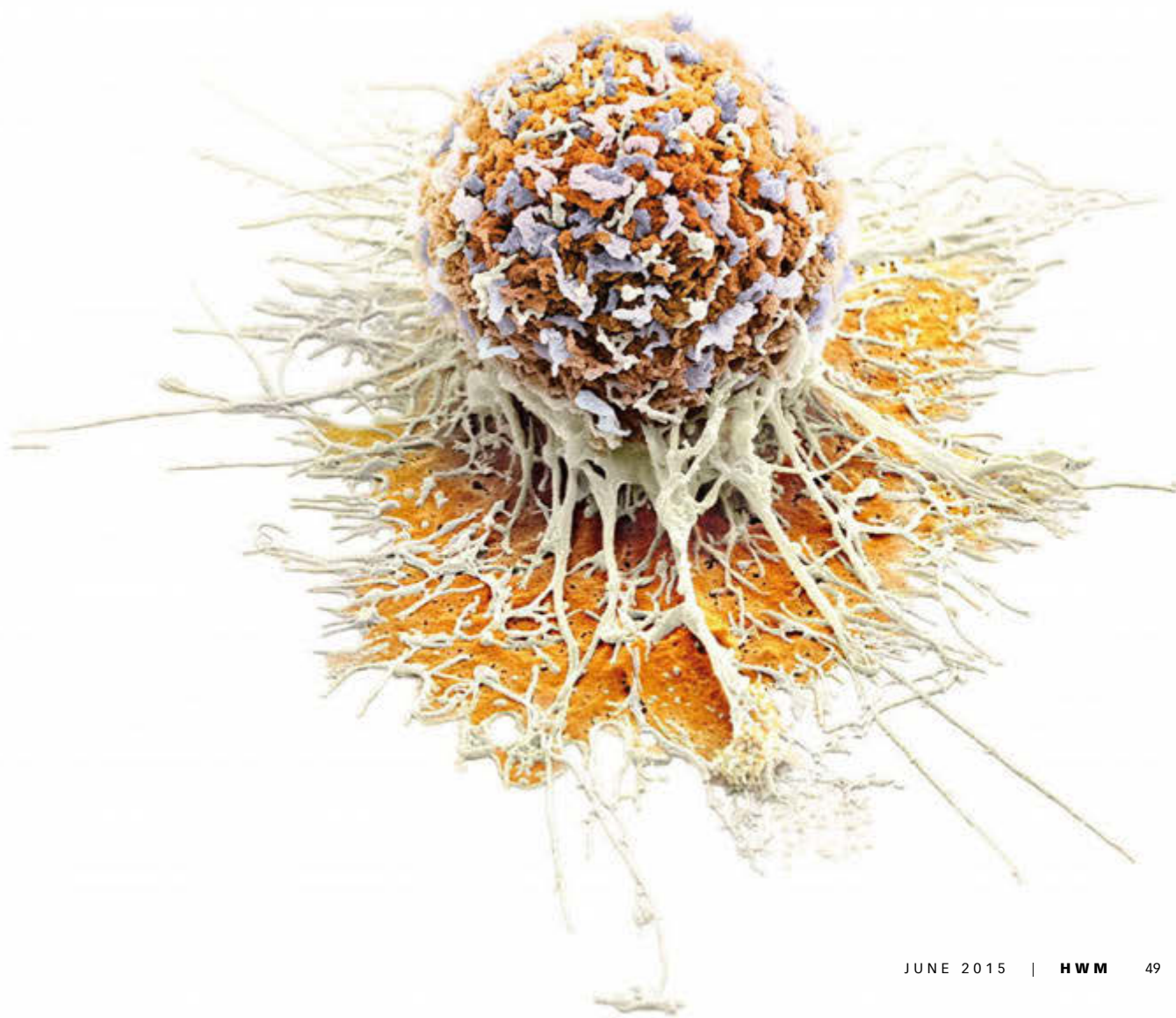
The new technology is based on digital holography, which constructs 3D images of cells using a device that clips onto any smartphone. Cell samples are inserted into this device and light is then shone onto the sample, which returns unique patterns of diffracted light that are in turn detected by the phone's camera.

This is made possible by the addition of microbeads, which bind to specific molecules – like cancer markers or HPV DNA – and alter their diffraction pattern. A higher prevalence of disease markers will mean more microbeads binding to them. Your phone sends the resulting diffraction

pattern to a computer to reconstruct an image of the cells in the sample. The computer then sends the image and results back to your phone. The entire process is estimated to cost only US\$1.80 and will take just 45 minutes.

The microbeads can be modified to bind to different molecules to enable diagnosis of various infectious diseases and other types of cancer. The technology has already been tested with cervical and blood cancer markers and HPV.

Given that health-screening for diseases can often be time-consuming and costly, this new technology could see the greatest impact in low-income countries with poor access to healthcare. It could even benefit more developed nations, where a blood sample from a pricked finger could enable speedy home diagnoses.





**Our objective now is to drive new innovation. Roughly 20-25 percent of our revenue is put back into R&D, which drives the next phase of innovation.**



# Innovation beyond smartphones

MANTOSH MALHOTRA  
SENIOR DIRECTOR, BUSINESS DEVELOPMENT,  
QUALCOMM TECHNOLOGIES

by James Lu

## **The Snapdragon brand is probably the most popular mobile chipset out there right now. What's next for Qualcomm?**

We're working on maturing Snapdragon as a solution catered towards the entire segment. If you look at our product offering, it ranges from very high-end products that go into flagship devices all the way down to more affordable devices as well. So we have the 200, 400, 600, 800 series, and the way it works is, most of the innovation and R&D is done at the high-end, then there's a waterfall effect so slowly over time, those features are made available to the other categories.

Our objective now is to drive new innovation. Roughly 20-25 percent of our revenue is put back into R&D, which drives the next phase of innovation. In the past few years, there's been a lot of innovation on the smartphone side of things, but what we're looking at now is how this R&D and innovation can support other verticals as well.

## **What other verticals?**

From our perspective, the next big wave of growth will be the Internet of Things. Now, the Internet of Things can refer to almost anything that can be connected, so for us, we need to look at what verticals make sense for Qualcomm. And right now, we're focusing on automobiles, wearables and healthcare.

In addition, we're keen to pursue other good opportunities. For example, in Singapore, the government is very keen on the smart city initiative. We're eager to explore and be a part of that, and see how we can contribute to making Singapore a smart city.

## **How do you see Qualcomm affecting IoT?**

What we normally do is, we innovate

and create a proof of concept, and then the actual commercialization happens through one of our partners. In terms of the consumer benefit, let me give you an example from healthcare.

Ultrasound machines used to cost tens of thousands of dollars, but now you can get a portable one with internet connectivity for a few thousand dollars. A lot of people think that these more medically advanced technologies are only useful in more advanced markets, but we don't think that's the case, we think it should be available for everyone. For example a village in Indonesia or the Philippines, could have a midwife carrying one of these portable connected machines and go around and check all the pregnant women, and if something is found that's not right, that data could be emailed back to a doctor in a hospital in the city for further analysis. If we look at it more creatively, we think these innovations should not be limited to just the more affluent societies but across the board.

## **What would you say to people who think mobile processors have reached their limit?**

It's funny you say that. We thought the same thing when we came up with dual-core processors, and then again with quad-core, and then again with octa-core. There will always be processor improvements, whether it be in terms of sheer speed or through better battery life via improved power efficiency, but really, you can't just tie smartphone performance to the performance of the processor, the bigger picture here is how we can improve on user experience.

For us, going forward, it won't just be about how fast your processor is, we see it being about the services associated with your smartphone. We

used to say that your phone can do voice calls, SMS and connectivity. In the future, I think we'll say that your phone can also do voice calls, SMS, and connectivity. We see an entire portfolio of services that will be driven by multiple devices that will talk to each other: multimedia, broadcasting, gaming, security, connected homes, connected cars. That will be the next wave of consumer benefit.

## **You've talked about what Qualcomm is planning down the road, but is there anything consumers should look out from Qualcomm this year?**

This year, our focus will be on migrating users from 2G to 3G and 4G technology. The benefits that 4G connectivity bring haven't been reaped by a lot of people, especially in emerging markets like South-east Asia. One of the other things we're keen on this year is LTE Broadcast, so we're looking at how we can work with the telcos to commercialize this technology and bring it to the consumer. With LTE connectivity, there are more and more data hungry apps, especially video. So how do we come up with something that can cater to the needs of thousands of consumers? With LTE Broadcast you can allocate a certain amount of LTE bandwidth and dedicate it to eMBMS (Evolved Multimedia Broadcast Multicast Service) and use it to simultaneously stream high quality live broadcast videos to a virtually unlimited number of mobile users in densely populated areas. The solution makes the most efficient use of mobile frequency spectrum and network resources.

Singtel will be trialling live LTE broadcast at this month's SEA Games held in Singapore from 5-16 June).



# The Cloud is the future

SERGUEI BELOUSSOV  
CEO, ACRONIS

by Koh Wanzi

**Increasing amounts of data are migrating into the cloud. As consumers and businesses become more dependent on cloud storage, what do you make of the security concerns surrounding it?**

Concern about the cloud is only natural, but I think this apprehension will dissipate over time as the younger generation enters the workforce. This is a generation of digital natives who grew up around technology and the cloud. They don't distinguish between online and offline activities – everything is just a part of their lives. For instance, when they upload a picture to Facebook, they don't make much of the fact that they're effectively uploading the image to the cloud. It's just something that happens naturally.

A good way of thinking about data migration to the cloud is to think about how people used to store their personal wealth. They used to keep it in their homes, but today we put our savings in the bank. In those days, people were distrustful of banks – just as some distrust the cloud now – but no one makes a big deal about leaving your life savings with the bank anymore. This parallels the progression of cloud storage, where it will become the most obvious, and eventually the only way, to store data.

**How are cloud services more secure than traditional on-site storage?**

Safety, privacy and security are the top concerns when it comes to cloud storage and backup. When people store data on-site instead of in the cloud, they risk losing vital data to unforeseen circumstances

like natural disasters or theft. Data stored on-site can also be extremely vulnerable to something as simple as human error, which is responsible for up to 29% of cases of data loss. A wrong click could result in the irreversible loss of crucial data, but this could be averted by simply utilizing cloud storage and backup services.

Cloud storage can help mitigate the risks of data loss by storing your data in a highly secure off-site data center, which is continually maintained to ensure data integrity and built to withstand even natural disasters. There are people who work full-time to ensure your data is safe and secure, which is more than most companies can spare for an on-site local server.

**What are some of the trust and privacy issues associated with the cloud?**

People worry that the data stored in the cloud can be pegged to their identity. So when it comes to sensitive data – data that they may not want people to know they have – they feel more secure storing it on-site or in their homes. This is actually a misconception as proper cloud storage providers store data anonymously. On the other hand, having the data discovered on your property is a far surer way of having the data linked back to you.

The best way to keep secrets is to show that you don't have them. We cater to a wide range of businesses and consumers, and it's important to communicate transparently with customers according to their varying needs.

**How can cloud backup technologies guard against digital obsolescence?**

Backup services can make copies of digital media, documents, and application data. Even the app itself is data, which can be preserved indefinitely. This is especially pertinent to people involved in digital arts like photographers. For these people, data is essentially their legacy.

The cloud allows precise digital copies of data to be made and preserved for the future. Consider Michelangelo's David. There is only one David and should it be destroyed, it would be gone forever. However, cloud backup technologies ensure a far more enduring existence for digital media, data and even applications.

**How do you envision the future of cloud storage and computing?**

We're at the beginning of a huge transformation in terms of data and storage. In the future, there will be even tighter integration of data source, destination and data management. The vast majority of data will be stored in the cloud and there will be no such thing as unprotected data.

Everything will be encrypted, and cloud storage solutions will be even cheaper, more comprehensive and less invasive for users. This places greater control in the hands of users as they can now manage all their data from one place. This also means that we will never lose any piece of data again. For instance, if you wanted to find an email containing a business plan from a few years ago, you would be able to do so easily by simply retrieving it from the cloud.

“

Cloud backup technologies ensure a far more enduring existence for digital media, data and even applications.

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**SCADA systems;  
they're everywhere.  
They practically  
manage your entire  
country!**





# The changing threat landscape

EUGENE KASPERSKY  
CEO AND FOUNDER, KASPERSKY LAB

by *Marcus Wong*

## **With the world getting more and more connected, how do you see the internet threat landscape changing?**

Well what's going on right now is that we have attacks only on the computer and on the mobile. But we expect to see attacks on Smart TVs soon. We don't know when, but it's quite obvious that the next victims will be Smart TVs, but then in the future, possible attacks will be on the smart cars, smart watches... many other smart things.

You call it the internet of things, I call it the "Internet of threats". I'm afraid in the future, many other devices will be under attack. And not just consumers or office networks, but also on industrial systems with physical effects.

## **What form will these attacks take?**

We have reports on attacks on industrial systems that are both criminal and sabotage attacks. For example, criminals attacked the sea port of Antwerp. Hacking into the logistics system, they were transporting containers with cocaine; they were unloading cocaine to one of their safe places. So, that's an example of criminal attacks on infrastructure.

For sabotage attacks, we're lucky for now, as there're not many yet. But the latest example of such an attack is on a steel mill in Germany. First they attacked the mill's SCADA (Supervisory Control And Data Acquisition) system and sent their own instructions which led to an emergency shut down of the steel mill which resulted in physical damage.

We don't have hard data about the attackers and the damage, but the German agencies confirmed that there was physical damage to the mill.

## **Is there anything the individual can do when it comes to cyber warfare then?**

I'm afraid not. Because it's like a war. Can individuals on the street protect the country in a war? No. It's the government's job. To protect national equanimity from these cyberattacks – it's a government's job. That's why many governments now have their own cyber agencies to handle cyber issues.

In fact, I recently had a meeting with the Singapore cyber agency, which was very interesting, because if you think about it – which country is more computerized than Singapore (per capita)?

## **Japan perhaps?**

Well, not if you consider per capita because in Japan there are still many villages. Maybe only the Vatican! But anyway, Singapore is right to be very concerned because there are many critical systems here that are open to attack. SCADA systems; they're everywhere. They practically manage your entire country! If the bad guys are able to take control of your airport for example, there will be big damage on the national economy and critical infrastructure.

## **What's the biggest headache for system administrators looking to secure their networks?**

Well, most computer users; the Microsoft Windows users, they're aware of these issues so most of them use some sort of security. Mobile users... Still not. They're not aware. They've heard about mobile viruses but they don't really believe in them, or they think they're far away from them, so as a result they're very easily breached.

And the bad guys are looking there next – there was a report just the day before yesterday from Russia – a 25 year-old man who had managed to infect some 100,000 smart phones and stole about 1 million dollars from mobile banking. One person, 25 years old, and he did for maybe only a few months to a year, and he got about a million dollars – not bad!

## **Definitely. Finally, what's the most important thing for the person in the street to know?**

It depends on who you are. If you're just an end-user, please protect your system with good enough software, and don't trust anyone in the internet. If you receive an email with attachments from an unknown person; maybe it's better to leave it unopened. If you receive an email with attachments from someone you know; better to call him to check.

Or, if you receive an email on your mobile phone it's better to check it on your computer. Don't follow links that you get sent because criminals use these links to take you out of safety, so keep your mind switched on. It doesn't guarantee pure security.

Once there was a case when I was in a hotel many years ago, and I connected my laptop to the internet through the hotel. And actually, the homepage of the hotel was infected. Thankfully I had a very good internet security suite so it didn't do much damage.

For enterprises, you have to be paranoid. System security administrators have to pay more attention to security audits and training. It's a good idea to have a cyber-response team so if something happens; they already have a team of people to investigate what's going on.

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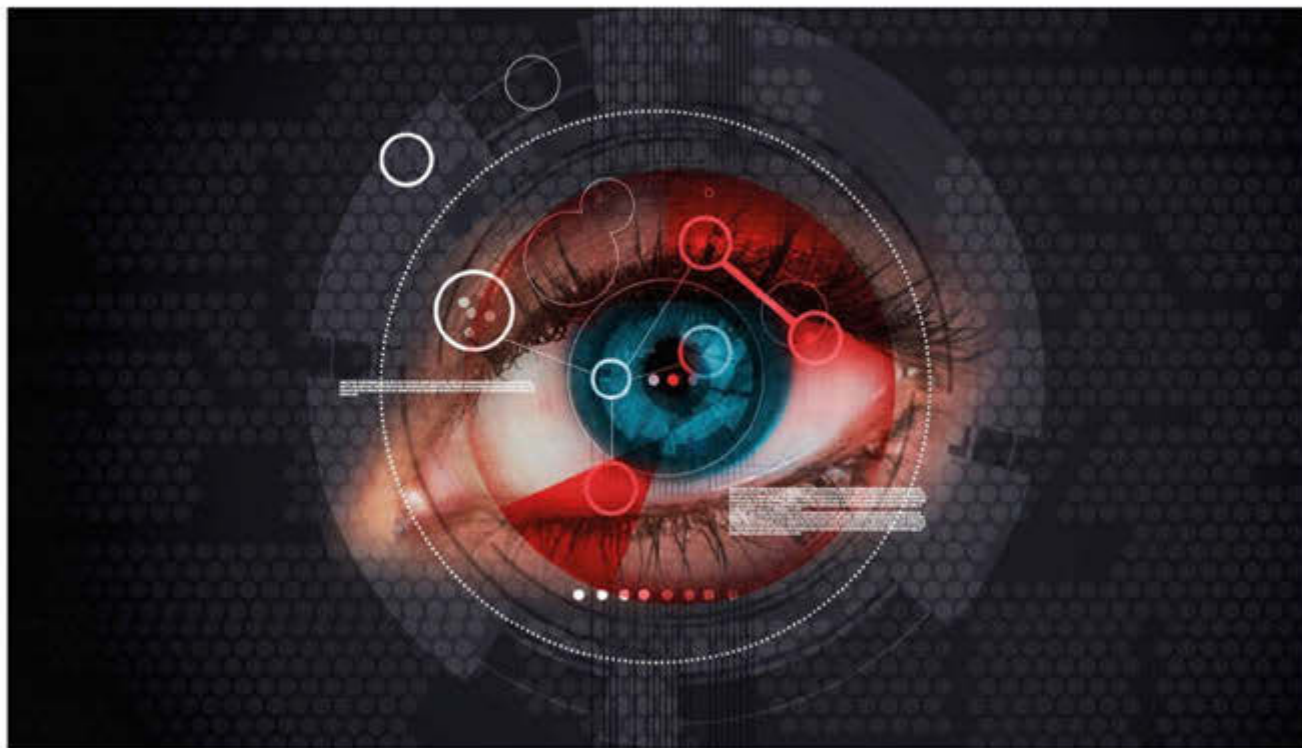
FEATURE

# WHAT MAKES YOUR SMARTPHONE SMART?

It's often said that even the cheapest smartphone today is more powerful than the computers NASA used to land Apollo 11 on the moon in 1969. But from octa-core processing to wireless charging and quantum IPS displays, just how much do you know about the only gadget you never leave home without?

Text by **James Lu & Koh Wanzi** Art Direction **Ken Koh**





## WHAT'S THE HIGHEST RESOLUTION THE HUMAN EYE CAN SEE?

The display is one of the most important features of any mobile device; after all, you spend most of your time staring at it. Display resolution has rapidly increased in recent years. Just five years ago, the standard resolution for a 4-inch display was 800 x 480 with 233ppi (pixels-per-inch). Today, the Samsung Galaxy S6 boasts a 5.1-inch QHD screen with a 2,560 x 1,440 pixel resolution. That works out to be 577ppi. But how many pixels do you really need?

The closest a human eye can focus is about 10cm. At this distance the smallest pixel size that can be distinguished would need to be 0.0116mm wide for a tiny percentage of the population, or about 0.029mm wide for the human average. Based on this, at a distance of 10cm, the very best eye would need a resolution with 2190ppi before it would no longer be able to determine individual pixels, while the average eye would need just 876ppi. Of course, no-one holds their phone that close to their face. At the average reading distance of 30cm the best eye needs 720ppi to make pixels indistinguishable, while the average eye needs just 300ppi.

**THE VERY BEST EYE WOULD NEED A RESOLUTION WITH 2190PPI BEFORE IT WOULD NO LONGER BE ABLE TO DETERMINE INDIVIDUAL PIXELS, WHILE THE AVERAGE EYE WOULD NEED JUST 876PPI.**

## LCD OR AMOLED?

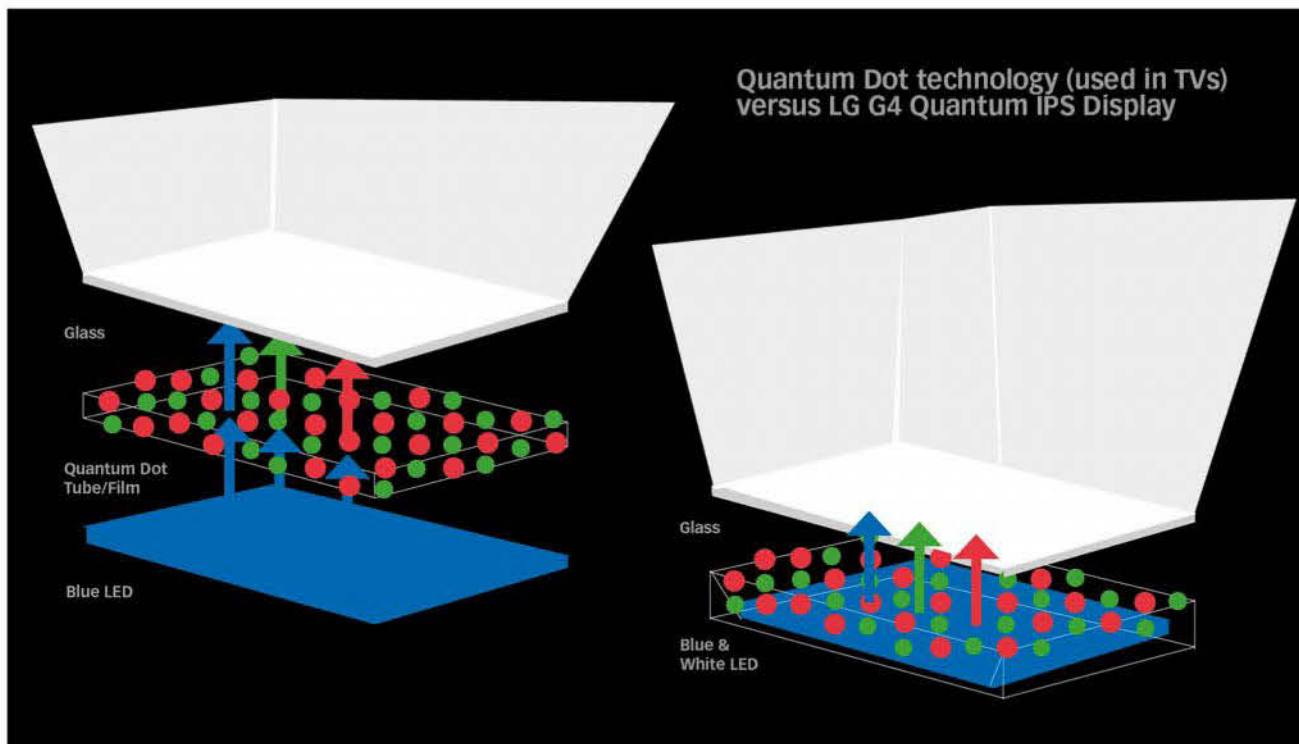
Resolution is just one aspect of display technology. The technology driving your display also plays a large part in determining how good your smartphone screen is.

### LCD

The most common type of display used on smartphones today is LCD (Liquid Crystal Display). LCDs use a backlight which lights the entire screen, even the supposedly black areas. Liquid crystals are then manipulated via electrical charges to cover or not cover pixels as needed, thereby letting more or less light through. LCD screens are generally bright, with good color accuracy, but as the backlight is always on, they can never deliver true blacks, which generally end up looking slightly blueish in dark environments. Some LCD displays are differentiated as being either TFT or IPS. TFT stands for Thin Film Transistor, which makes the wiring of LCD screens more efficient by reducing the number of electrodes per pixel. IPS stands for In Plane Switching, and improves upon TFT by offering much wider viewing angles by keeping the liquid crystals parallel to the screen.

### Super LCD

HTC uses Super LCDs in its HTC One flagship phones. Standard LCD displays have an air gap between the outer glass and the display element, but with Super LCD that gap is



removed, which makes the screen brighter, reduces glare and improves power efficiency.

#### Quantum IPS LCD

The LG G4 uses a new LCD technology called Quantum IPS LCD. The technology is similar in principle to Quantum Dot LCD technology found in some high-end TVs, which uses a blue LED backlight and a film or tube layer to create reds and greens to display a wider and more vibrant gamut of colors. Quantum Dot screens are not suitable for smartphones as they would require not only a larger bezel but also a thicker panel. LG's solution is to use both a blue and white LED backlight, and instead of the tube or film layer, potassium and nitrogen based compounds work in combination with the blue LED to achieve red and green colors. This results in a 25 percent brighter display over traditional LCD displays, as well as the improved color and vibrancy of Quantum Dot technology, without any of the associated thickness.

#### AMOLED

AMOLED stands for Active Matrix Organic Light-emitting Diode. Rather than a single backlight, AMOLED displays use millions of individually controlled organic-LED light sources. The brightness of each LED pixel is controlled by the current provided through the backplane transistor, which is adjusted via the transistor's gate voltage. The AM part of the name stands for active-matrix, which simply refers to the switching transistor technology used to

control each LED pixel. AMOLED displays can also provide high accuracy colors, and they also have an advantage against LCD displays by providing a wider contrast ratio with true blacks possible by dimming individual pixels. This can also save battery life. However, peak power draw for high brightness levels is often higher than LCD displays and AMOLED displays can also suffer from problems with organic-LED degradation over-time, which can lead to

burn-in and color loss over parts of the screen.

#### SUPER AMOLED

Super AMOLED is a technology used by Samsung where the touch digitizer is built into the display rather than in a separate layer on top of the pixels. This has the added benefit of reflecting less light, increasing touch sensitivity and allowing for slightly higher peak brightness.





## SYSTEMS-ON-A-CHIP

Smartphone progress is often measured in millimeters. More precisely, how many millimeters companies can shave off their next flagship device. To cut down on weight and size, manufacturers have taken to integrating and optimizing as many parts of a computing system as possible onto a single chip.

In theory, a System-on-a-Chip (SoC) would integrate everything ranging from the CPU and GPU to memory, storage controllers and even LTE modems. Some SoCs also include smaller co-processors that perform functions like video encoding and decoding and image processing.

However, not all SoCs are created equal. Smartphone SoCs today primarily utilize either one of two architectures: ARM or Intel. ARM typically delivers high performance and good power efficiencies, so the bulk of processors today use ARM-based architectures – Qualcomm's Snapdragon, Apple's A-series and Samsung's Exynos processors all draw on ARM CPU cores or instruction sets.

On the other hand, Intel's dominance in the desktop processor market isn't reflected in the mobile space. Intel has adapted its x86 desktop architecture for mobile SoCs, but so far it hasn't been able to match ARM for power consumption on the same fabrication

process. Last year's 28nm Snapdragon 805 is roughly on par with 22nm Intel Silvermont Atom processors in terms of thermal properties. Intel x86 also differs from ARM in terms of how individual instructions are handled to balance power consumption. In a nutshell, ARM uses Reduced Instruction Set Computing (RISC) while Intel uses Complex Instruction Set Computing (CISC). RISC instruction sets tend to be more granular while CISC's are larger and more complex. Each RISC instruction translates into a single operation for the CPU to perform, but CISC instructions are expressed as a

broader idea for the CPU to execute in multiple, smaller steps.

To put things simply, RISC has more efficient instruction decoding as it is closer to CPU microcode operations. Nevertheless, some argue that CISC could gain an edge as smartphones handle increasingly complex computations. However, we can no longer arbitrarily attribute raw performance to Intel x86 and power efficiency to ARM – the gap between both architectures is narrowing and they both have much more in common today than when they first started out.

## MORE POWER!

Regardless of whether your phone houses an SoC based on Intel x86 or ARM microarchitecture, chances are it uses a multi-core processor. If you think octa-core sounds like a lot, wait till you hear that MediaTek recently announced plans for a 10-core SoC, the Helios X20. Multi-core processing helps smartphones cope with a multitude of demanding tasks like 4K video recording and performance-intensive 3D games, all while remaining within an acceptable thermal envelope.

A good example to illustrate how multi-core processing works is the octa-core Qualcomm Snapdragon 810, which is found on flagships like the HTC One M9 and Xiaomi Mi Note Pro. Like the Exynos 7420, the Snapdragon 810 uses ARM's big.LITTLE

heterogeneous computing core management scheme for its four Cortex-A57 and four Cortex-A53 cores. The more powerful Cortex-A57s are the "big" cores, while the energy-efficient Cortex-A53s are the "LITTLE" part of the equation.

With multiple cores, each core can be assigned individual tasks when needed to help speed up simultaneous processing. Under low loads, the cores can also slow

down, thus helping to conserve power.

Any combination of the eight cores in the Snapdragon 810 can be operational at any one time, depending on the system's workload. While the phone is sleeping, the low-power Cortex-A53 can handle background processes efficiently. If you suddenly wake your phone to play a game, the Cortex-A57 ramps up independently to handle the new workload without interrupting the A53 core.

**WITH MULTIPLE CORES, EACH CORE CAN BE ASSIGNED INDIVIDUAL TASKS WHEN NEEDED TO HELP SPEED UP SIMULTANEOUS PROCESSING.**



## Just how waterproof is your smartphone?

Some smartphones, such as Sony's Xperia Z range, are built to be resistant to dust and water. But just how resistant are they? All devices are rated on the Ingress Protection (IP) two-digit scale, for example the Xperia Z3 is rated IP58. The first digit indicates the level of protection against solid objects, including dust, while the second indicates how resistant the device is to water.

### Dust

- 1 - Protected against solid objects larger than 50mm in diameter
- 2 - Protected against solid objects larger than 12.5mm in diameter
- 3 - Protected against solid objects larger than 2.5mm in diameter
- 4 - Protected against solid objects larger than 1mm in diameter
- 5 - Protected against dust; limited ingress
- 6 - Complete protection against dust

### Water

- 1 - Protected against condensation or dripping water falling vertically.
- 2 - Protected against spraying water when tilted up to 15 degrees vertically.
- 3 - Protected against spraying water when tilted up to 60 degrees vertically.
- 4 - Protected against splashing water from any angle.
- 5 - Protected against low pressure water stream from any angle.
- 6 - Protected against high pressure water stream from any angle.
- 7 - Protected against water immersion. Immersion for 30 minutes at a depth of up to 1 meter.
- 8 - Protected against continual water submersion in under water conditions.



PICTURES SONY & APPLE

## BIOMETRICS CHANGE THE WAY YOU INTERACT WITH YOUR PHONE

Remember when all you could do with your phone was call, message and try not to eat your own tail on Snake? Today, phones are crammed with an array of biometric sensors, able to authentic your fingerprints, monitor your heart rate, and even count your steps. When it comes to fingerprint sensors, you can thank Apple for kickstarting that trend. Apple's TouchID first appeared on the iPhone 5S, and uses a 500ppi capacitive touch sensor that is capable of 360-degree readability and also eliminates the need for a swipe gesture. The sensor is in turn surrounded by a steel ring that detects your finger and

tells the scanner when to begin scanning for a print. This helps conserve power, so the sensor isn't always waiting to detect a print. A tough sapphire lens protects the sensor, ensuring that scratches won't interfere with the sensor's ability to read your print. After scanning your finger, information about your print is temporarily stored in a secure enclave for analysis and matched against the data stored on your iPhone. This data is actually a mathematical representation of your print, which resides in a secure section of the A7 SoC that is not accessed by iOS. To further bolster security, Apple says that it doesn't store images of your actual print on device memory or the cloud. Looking forward, the next big jump in fingerprint scanner technology seems to be ultrasonic scanning, which uses soundwaves to capture a 3D scan of your fingerprint. Qualcomm is currently developing the technology, which is said to be able to work through glass, metal, plastic and unlike TouchID will continue working regardless of if your finger is dirty, greasy or wet.

**A TOUGH SAPPHIRE LENS PROTECTS THE SENSOR, ENSURING THAT SCRATCHES WON'T INTERFERE WITH THE SENSOR'S ABILITY TO READ YOUR PRINT.**

Many smartphones include a heart rate monitor, which is often used with a variety of pre-loaded fitness apps to help users get more utility out of the sensor than just figuring out what their pulse is. These sensors work by using an LED light that illuminates the pulses of blood as it moves through your finger. The sensor then measures these pulses and makes a calculation for your heart rate per minute.

And if you don't want to get a dedicated fitness band to count your steps, your phone can do that for you too. Many modern smartphones like the iPhone 6 and Galaxy S6 use combinations of the phone's various sensors to count your steps. The phone's accelerometer detects non-gravitational acceleration of your phone, which allows it to measure changes in velocity when you walk around with the phone in your pocket.

Your phone can then leverage on data from the accelerometer and combine that with GPS information to get a more accurate reading of the number of steps you've taken. Some phones like the old Google Nexus 5 even have a dedicated pedometer to calculate your steps with greater precision.



# WHY SMARTPHONE CAMERAS HAVE REPLACED DIGITAL COMPACT CAMERAS



Whether you're taking photos of people, landscapes, or food, a good quality camera on the back of your smartphone is more important than ever. For many people, smartphone cameras have replaced digital compact cameras as their go-to device for everyday photography.

## Sensor and Lens: bigger is always better

All smartphone cameras are made up of two main components: the sensor and the lens. Almost all smartphone cameras use CMOS (complementary metal-oxide-semiconductor) sensor technology. A CMOS sensor is essentially a complex integrated circuit that typically includes photodetectors – the key component that captures light – plus amplifiers, transistors, and processing hardware. When light hits the photodetectors, the sensor captures information about the light hitting them. This information gets converted into a digital signal relating to the brightness of the individual light photons. To get color data, an RGB filter is layered over the array of photodetectors, and a software algorithm produces the final, full-color image. What differs from smartphone to smartphone is how large the actual sensor is. Larger than average camera sensors, such as the 1/2.6-inch sensor used in the LG G4, can fit in more photodetectors, which means the sensor receives more light information. More information means better dynamic range, less noise and improved low light performance.

The second component is the lens. The lens focuses light onto the sensor so that the image is in focus and is actually a collection of multiple plastic or glass elements, each with a specific function in focusing the light onto the sensor. Generally speaking, the more elements a lens has, the better the image quality will be. Most high-end smartphones use five element lenses, although some, like the LG G4 have six. The lens elements work in conjunction with an aperture, which is a hole before the sensor that the focused light travels through. The size of the hole determines how much light passes to the sensor. The larger the aperture, the more light hits the sensor, which means faster shutter speeds, lower ISO, and less noise and image processing. Larger apertures also have several other benefits. A very wide aperture, such as the LG G4's f/1.8 lens allows for a shallower depth of field, which can tastefully blur out the background, helping you isolate your subject. Most importantly, larger apertures result in clearer, sharper shots with more detail in dark environments.

## Autofocus

A great sensor and lens aren't much use if your photos aren't sharp and in focus, or if you miss the shot because your camera was too slow to focus. Here's where autofocus comes in. Smartphone cameras generally focus using contrast detection, which is entirely done on the software side by shifting the lens until there's maximum contrast between adjacent pixels. Some smartphone cameras such as the iPhone 6 and Samsung Galaxy S6 also use phase detection autofocus, which compares the actual light received by the sensor to fine-tune the focus.

LG uses a completely unique autofocus system, which we first saw in the LG G3, and has since been improved upon in the G4. LG's system uses a low-power laser which emits pulses of infrared light, which are then bounced back to the laser sensor. The sensor continuously measures the round trip travel times for each infrared pulse beam, establishing a precise range to the subject. After the image processor receives the measurements of exactly how far away the object is, it locks in the respective focus depth. This all happens in a fraction of a second, 0.276 seconds to be precise, which makes the LG G4's laser focus the fastest autofocus system on any smartphone camera.

**A GREAT SENSOR AND LENS AREN'T MUCH USE IF YOUR PHOTOS AREN'T SHARP AND IN FOCUS.**

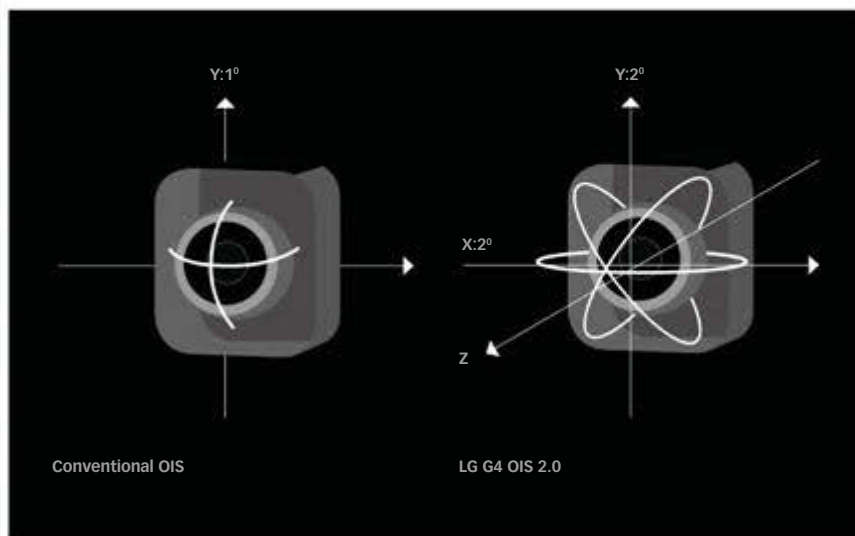
## Optical Image Stabilization

Smartphones are almost always used handheld when taking images, which is why image stabilization is crucial. There are two main forms: optical image stabilization (OIS), which is hardware-based,

and electronic image stabilization (EIS), which is entirely done in software. OIS is always preferred as it gives better results, but is more expensive and more complex to integrate. OIS works by placing the camera lens module inside a stabilized rig.

Using information from a gyroscope placed near the camera, the entire rig is shifted with electromagnets to counteract the physical movement of the device. This keeps the optical elements in the same relative position.

Most OIS systems work on dual X and Y axes. LG's G4 is the only phone with a third Z axis, which also compensates for front and back movement.



Advanced image stabilization technologies that compensate for more movement axes are now found on mobiles.

# WIRELESS CHARGING EXPLAINED

Thirty years ago, wireless telephones were almost unheard of. Now, some smartphones don't even need a wire to charge them. Palm was the first company to commercially introduce wireless charging with its Touchstone Wireless Charging Dock back in 2009 - since then hundreds of devices, from Microsoft's Lumia 930 to Samsung's Galaxy S6 have hit the market with wireless charging capabilities.

There are two types of wireless charging technology commonly in use today: Inductive and Resonance.

## Inductive Charging

Electromagnetic inductive charging works by using an electromagnetic field to transfer energy between two objects: the charging base or plate, and the device itself. The charging plate is connected to a power supply, and has a coiled wire inside it. Anytime electrical current flows through a wire, a small magnetic field is created around that wire. Coiling the wire around itself many times amplifies the magnetic field - the more loops in the coil, the larger the magnetic field. The device to be recharged also has a smaller coiled wire inside it. When this wire is placed into the magnetic field generated by the charging plate, an electrical current is induced in the wire. The induced current can then be modified using simple electrical components to produce a stable power supply that can charge the device's battery. The limitation to inductive charging is that the charging and receiving coil must be in very close proximity, due to the small size of the magnetic field. Most wireless charging smartphones today use Inductive charging.

**THE LIMITATION TO INDUCTIVE CHARGING IS THAT THE CHARGING AND RECEIVING COIL MUST BE IN VERY CLOSE PROXIMITY.**

Anytime electrical current flows through a wire, a small magnetic field is created around that wire. Coiling the wire around itself many times amplifies the magnetic field - the more loops in the coil, the larger the magnetic field.

TRANSMITTER COIL

The charging plate is connected to a power supply, and has a coiled wire inside it.

RECEIVED COIL

The device to be recharged also has a smaller coiled wire inside it. When this wire is placed into the magnetic field generated by the charging plate, an electrical current is induced in the wire.

Every wirelessly charged device consists of two components, a charging base or plate, and the device itself.

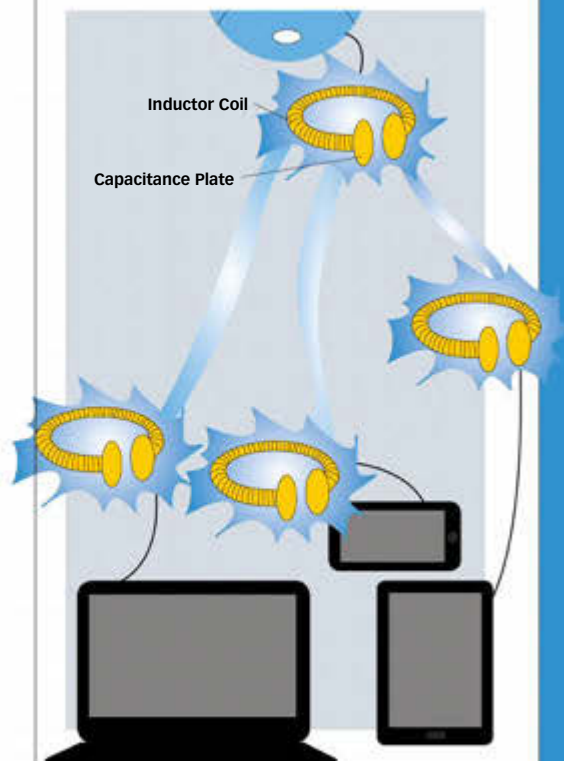
## Resonance Charging

In 2007, a team at MIT reported that they had discovered an efficient way to wirelessly transfer power between coils separated by a few meters. The team theorized that they could extend the distance between the coils by adding resonance to the equation.

Resonance can be thought of as the specific frequency that causes a particular object to naturally vibrate. Resonant frequency is what can cause a wine glass to shatter when a note with a specific frequency is played next to it - the resonance causes the glass to vibrate, shattering it.

The MIT team discovered that induction can take place between two coils if both the charging coil and the receiving coil share the same resonant frequency. Using this principle, they were able to successfully power a lightbulb over two meters away from its charging coil. Resonance charging in smartphones uses the same principle, and greatly extends the wireless charging range. This also lets resonance charging plates operate through tables

or other objects. The added range also easily allows for multiple devices to be charged at the same time - as long as each shares the same resonant frequency. Resonance charging is a fairly new technology, but is expected to overtake Inductive charging in the next few years. **HWM**







This year is the 6th edition of the annual HWM+HardwareZone.com Tech Awards. 32 Editor's Choice and 37 Readers' Choice awards were handed out in categories ranging from computers and consumer electronics to digital entertainment, communications and services.

We presented our Editor's Choice awards in the last issue of HWM, as well as our reasoning for picking the winners. This month, we reveal the winners and breakdown of votes that make up the Readers' Choice portion of our awards. In the next few pages, you'll find the best technology brands in the industry, as voted by you.

Text by **Team HWM**

Art Direction & Illustrations **Ian Chong**



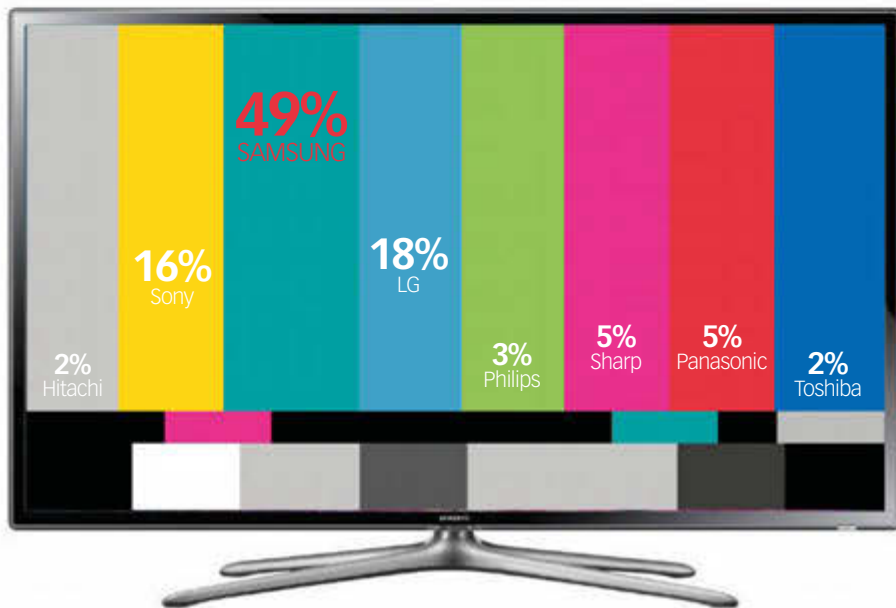
## Best 2-in-1 Notebook Brand

Some call it notebook-tablet hybrids, some call it 2-in-1 notebooks. Whichever the case, this new form factor came about due to the multifaceted nature of Windows 8; and soon, Windows 10. We asked which is your favorite 2-in-1 notebook brand, and you responded. The inaugural winner of this award is ASUS, maker of the popular Transformer Books, with 34% of your votes. Lenovo, with their multi-mode Yoga 3 Pro came in second at 23%; and Microsoft third (15%), after getting the formula right with the Surface Pro 3.

PICTURE ASUS

## Best TV Brand

As mentioned in our CES 2014 and 2015 roundups, the TV market over the last couple of years have been about 4K UHD, OLED and curved TVs. One additional observation made this year is that TV manufacturers are now turning to mobile operating systems en masse for a more familiar user experience. Samsung, this year's Best TV Brand with 49% of the votes, has announced that its smart TV platform will be based on the Tizen OS moving forward. Its quantum dot-based SUHD TVs that we saw at CES are also expected to hit retail very soon. Second place LG (18%) has also begun selling its WebOS 2.0-based 4K TVs recently. Sony, which has opted for Google's Android TV platform, completes the top three with 16% of the votes.



## Best Keyboard & Mouse Brand

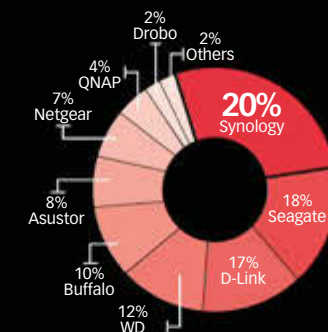
The contest for our new Best Keyboard & Mouse Brand award involves more than 15 brands, but the top three already garnered 70% of the votes. At the end of the day, the trophy goes to Logitech, who received 37% of all votes cast. Trailing behind are Razer and Microsoft, with 24% and 12% respectively. From these results, it's pretty clear that Logitech has achieved considerable mindshare with its wide range of keyboard and mouse offerings. From everyday wireless keyboards and mice, to gaming-oriented keyboards and mice, to portable keyboards for iOS devices, the company seems to have something for everyone.



PICTURES: SAMSUNG • LOGITECH

## Best Gaming Notebook Brand

In 2014, we saw the introduction of the Alienware 13, the company's smallest gaming notebook yet (plus the audacious Alienware Graphics Amplifier). This year, Alienware tried their hand at thinner and lighter versions of their established Alienware 15 and 17 models, all of which managed to keep them firmly as your top choice (33%) for a gaming brand. ASUS has been very aggressive on all fronts, but it is local custom notebook outfit Aftershock PC that has made the most impact over the past few years. Both ASUS and Aftershock tie for second place with 16% of votes each.



## Best NAS Brand

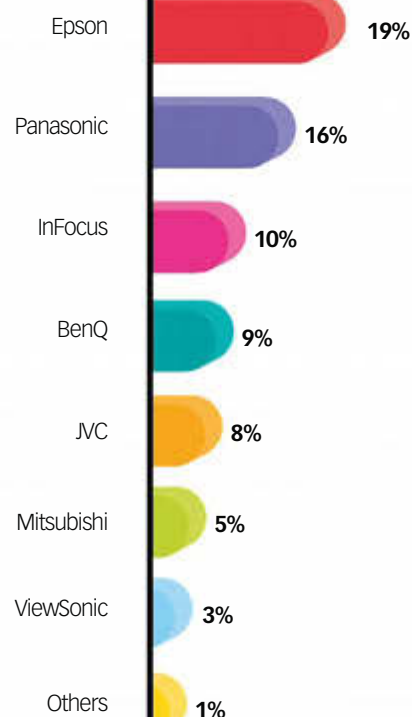
Our NAS (network-attached storage) category has always been hotly contested, and this year sees more than 11 brands competing. With 20% of the votes, Synology is your favorite NAS brand this year, beating the likes of Seagate (18%), D-Link (17%), and WD (12%). In fact, this is a bit of a surprise to us, as Synology only placed fourth last year. One thing's for certain though, as its product page shows, the Taiwanese company has expanded with a wide range of storage solutions to meet the needs of different users, from large scale enterprises, small and medium businesses, to home users.



## Best Home Theater Projector Brand

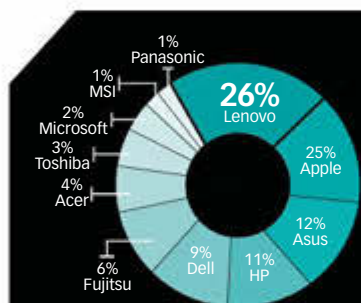
Once again, you've voted for Sony as your favorite home theater projector brand, snagging 29% of all votes cast. And we must agree that they've had a pretty good range with the excellent (but expensive) VPL-VW1100ES 4K projector and the amazing VPL-GTZ1 ultra-short-throw laser light source 4K projector. Epson comes in second at 19%, while Panasonic is a close third at 16%.

**SONY**



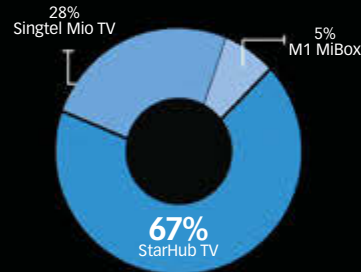
## Best Inkjet Printer Brand

With 41% of the votes, Canon is your favorite inkjet printer brand. Earlier this year, they introduced a new Maxify inkjet series that caters to the needs of small or home office users who require high-volume color printing, plus advanced security, network and cloud connectivity features. We reviewed and found that the flagship MB5370 does indeed live up to its claims, which shows Canon's continued push to innovate in a rather static (some say boring) category. Second and third place go to HP (20%) and Epson (18%) respectively.



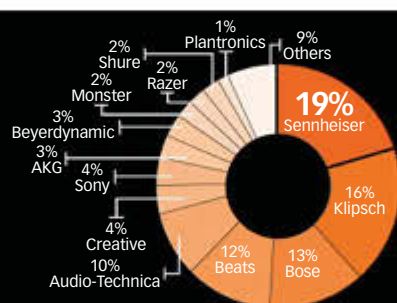
## Best Business Notebook Brand

The trophy remains in the hands of Lenovo (26%), currently the world's largest PC maker. That said, Lenovo's win is a very narrow one as Apple comes within touching distance with 25% of votes. Looks like many of you are using MacBooks at work.



## Best Pay TV Service (Singapore)

Despite strong competition from overseas streaming services, StarHub's Pay TV revenue remained stable YoY for 4Q 2014. They've even launched a new IPTV service called StarHub TV on Fiber. It's no wonder that StarHub TV continues to be the top pay TV service.



## Best Headphones Brand

With more than a dozen brands, the headphones category is another hotly contested Readers' Choice category. After tallying the votes, German audio specialist Sennheiser retains the award for the fourth consecutive year (19%). Klipsch comes with second (16%) and Bose third (13%).



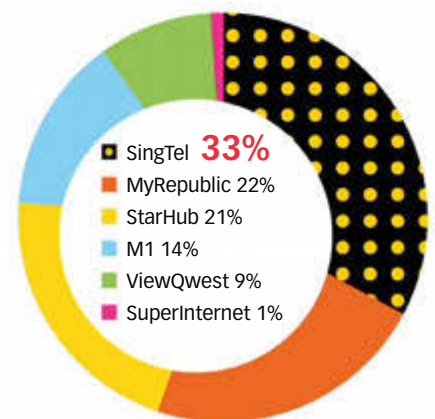
## Best Premium Smartphone Brand

Apple's strong showing late last year was no doubt due to the iPhone 6 and 6 Plus; but last we heard, the Samsung's Galaxy Note 4 and Note 4 Edge sold very well too. The Korean giant has since followed that up with the Galaxy S6 and S6 Edge, arguably the best phones they've created to date. That said, for the second year running, a whopping 53% of you voted Apple your favorite premium smartphone brand. Samsung, which won the award two years ago, is second with 21%.



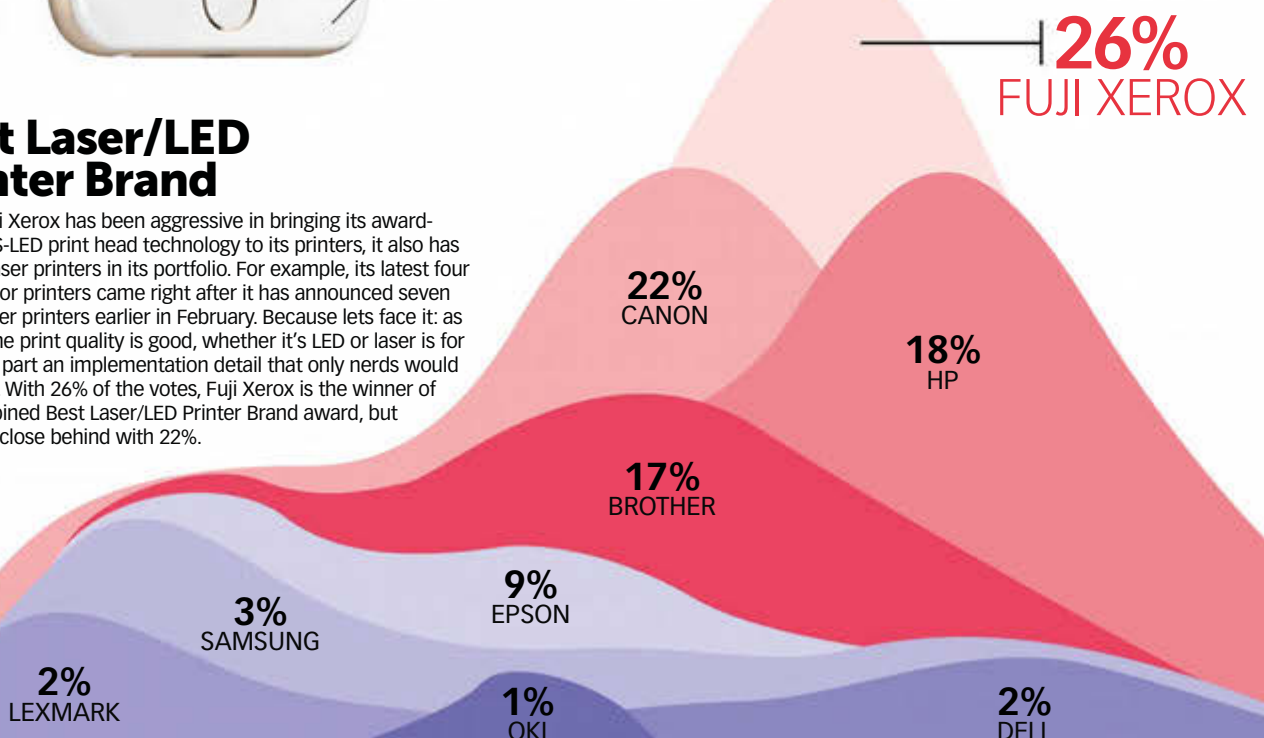
## Best Fiber Broadband Service (Singapore)

Compared to fixed line and mobile telephone services, the fiber broadband market in Singapore is a lot more competitive due to the presence of more providers. Still, Singtel has retained the award that it won last year with 33% of the votes, though underdogs MyRepublic has climbed to second place with 22%, overtaking both Starhub (third at 21%) and M1 (14%). MyRepublic was first to offer 1Gbps fiber plans at a very attractive \$49.99/month, while Singtel countered with an equal \$50/month 1Gbps Unlimited Fiber promotion recently. ViewQwest, which recently launched a 2Gbps plan, closes in on M1 with 9%.



## Best Laser/LED Printer Brand

While Fuji Xerox has been aggressive in bringing its award-winning S-LED print head technology to its printers, it also has several laser printers in its portfolio. For example, its latest four S-LED color printers came right after it has announced seven mono laser printers earlier in February. Because lets face it: as long as the print quality is good, whether it's LED or laser is for the most part an implementation detail that only nerds would fuss over. With 26% of the votes, Fuji Xerox is the winner of our combined Best Laser/LED Printer Brand award, but Canon is close behind with 22%.



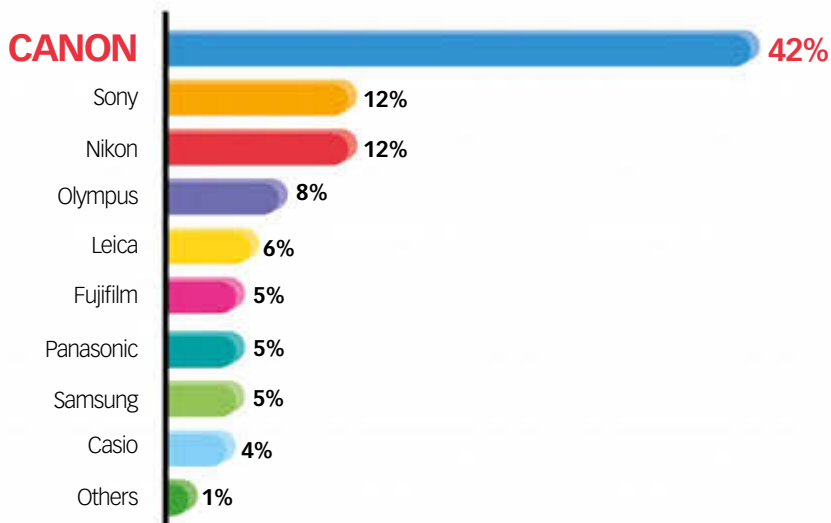


## Best Interchangeable Lens Camera Brand

In short, interchangeable lens cameras refer to both DSLRs and mirrorless cameras. According to CIPA, while mirrorless camera sales stabilized last year, DSLR shipments continued to drop. Interestingly, mirrorless cameras sales were down in Japan and Asia, but grew in Americas and Europe (a reason for their DSLR sales drop). As a result, you'll notice a sort of consolidation or more careful spending habits. Our results show that the traditional brands continue to hold sway in consumer minds as Canon takes in 41% of total votes. While Canon seems to only have introduced the EOS 7D Mark II and 1200D DSLRs the whole of last year; it already launched four this year, including the EOS 5DS/5DSR and 750D/760D. It has also recently updated its mirrorless offering with the EOS M3.

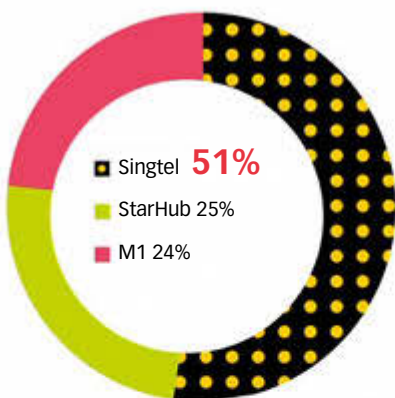
PICTURE CANON





## Best Compact Camera Brand

According to the Camera & Imaging Products Association (CIPA), digital camera shipments fell 31% in 2014 compared to 2013. Compact cameras were predictably the hardest hit, dropping 35% in shipment volume. But there's a saving grace: the volume was still greater than the amount of interchangeable lens cameras shipped. Thus, like what we've been saying for many years now, this segment is unlikely to die just yet. Camera makers are trying their best too, putting new features like wireless connectivity, larger sensors, and brighter lenses onto their compacts. For this Readers' Choice category, the winner is once again Canon, which amassed 42% of the votes. In 2014, we saw several excellent Canon compacts, like the PowerShot G1 X Mark II and G7 X; and earlier this year, we saw the launch of several more PowerShot and IXUS models, including the SX410 IS, a compact 20MP camera with a 40x zoom lens.

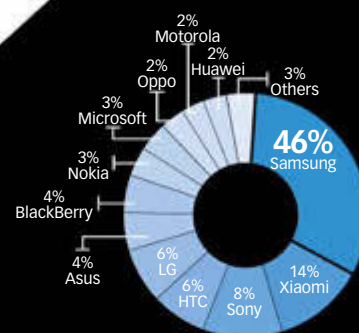
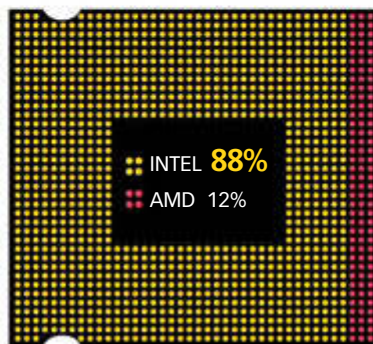


## Best Telco (Singapore)

Despite the recent brouhaha, Singtel remains the one to beat in this category, garnering 51% of the votes cast. The rebranded telco is also very busy exploring future cellular technologies recently, having announced a joint 5G innovation program with Huawei late last year, a partnership with Ericsson to study 5G networks at the start of this year, and a partnership with Ericsson to test out LTE broadcast and voice over Wi-Fi calling just last month.

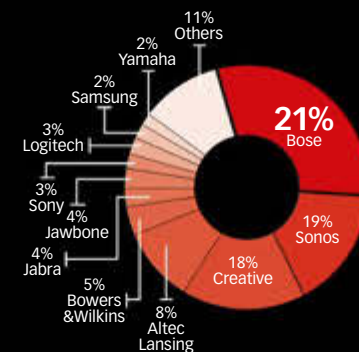
## Best CPU Brand

While it may be a different story for mobile chips used in smartphones, Intel is still dominant in the market for chips used in desktop and notebook PCs. 2014 saw the refresh of its 4th-gen Haswell processors and the arrival of the 5th-gen, 14nm-based Broadwell processors, which include the Core M, used by the latest super slim notebooks like the Lenovo Yoga 3 Pro, the ASUS Transformer Book Chi T300 and the 12-inch Apple MacBook. With desktop Broadwell chips incoming and the expected arrival of Skylake later this year, it's hard to see Intel relaxing its grip in this segment. That said, it won't be an easy road for Chipzilla either, as PC sales continue to decline in 2015.



## Best Mainstream Smartphone Brand

According to Gartner, while Samsung lost its No. 1 position to Apple in the global smartphone market in the fourth quarter of last year, it still sold over 300 million units throughout 2014. In other words, Samsung's mainstream phones like the Galaxy Alpha and Galaxy Ace series continue to see healthy sales and variety. Samsung retains the win a third year running with 46% of your votes. Coming in second though is actually Xiaomi, who has 14%. While not at all unexpected, Xiaomi becoming a firm competitor in the mainstream market means Samsung has a fight on their hands on both ends of the spectrum. While their lead here remains very wide, the coming years will be interesting.



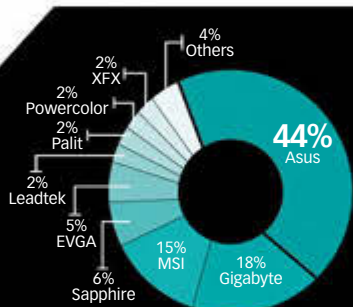
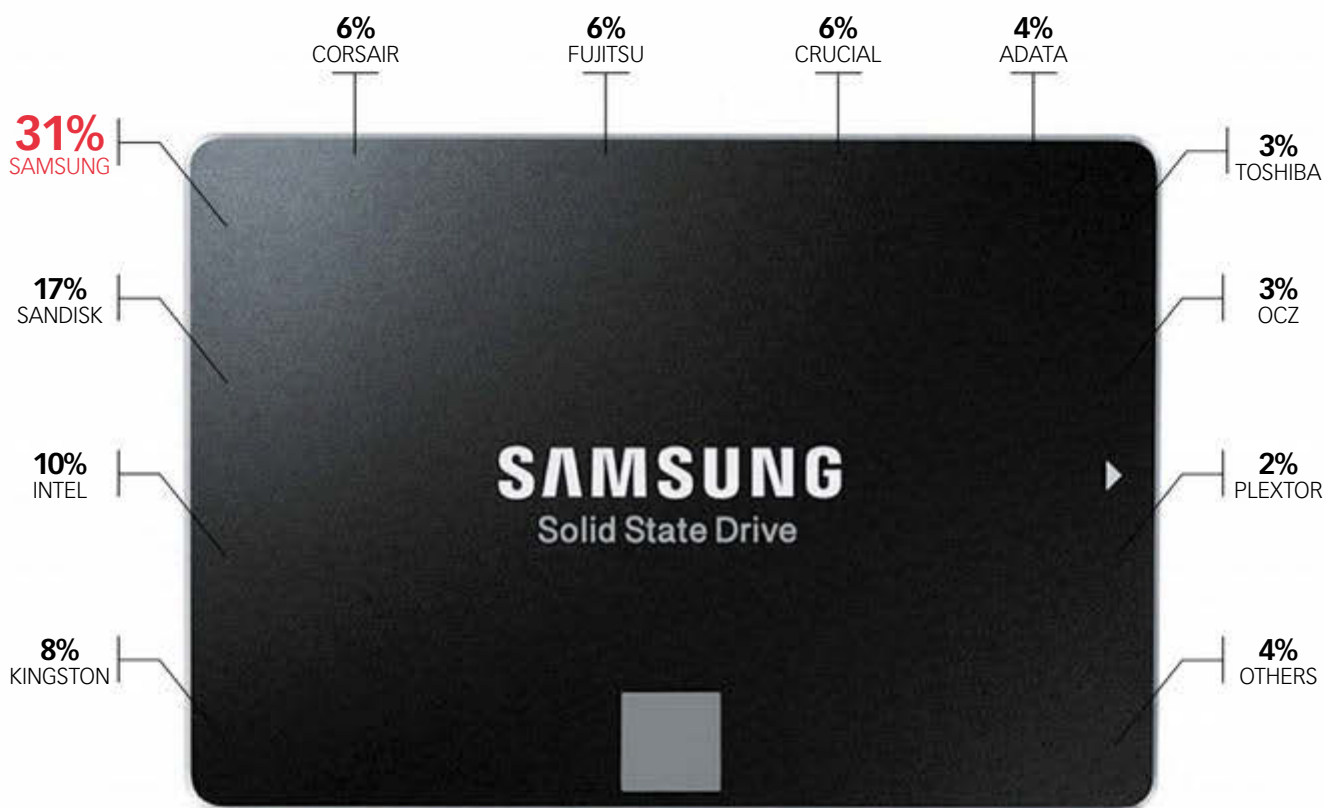
## Best Wireless Speakers Brand

The advent of mobile devices greatly contributed to the exploding growth of wireless speakers in recent years, replacing the dedicated speaker dock trend. Plus, as audio and streaming technologies continue to improve, the gap between audio quality continues to diminish as well. For the third year running you've voted Bose, maker of the SoundLink III and SoundLink Color Bluetooth speakers, as your favorite wireless speakers brand. The company has also just launched its SoundTouch Wi-Fi speakers in Singapore. However, boutique audio brands are starting to lose ground to tech brands as seen here. Sonos and Creative are just a few percent points behind.



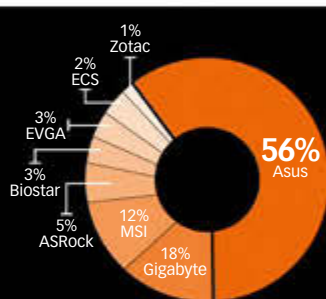
## Best SSD Brand

While traditional spinning hard drives still hold the capacity per dollar advantage, there's no denying that when it comes to speed, solid-state drives totally mop the floor with HDDs. Better yet, prices have come down tremendously. Samsung, who was runner-up to SanDisk last year, is the winner this year with 31% of the votes. We can only posit that the great performances of its 3D V-NAND-based SSD 850 Pro and SSD 850 Evo didn't go unnoticed by our readers. For something more recent, know that the Korean company has in January started mass producing an extremely fast and low-powered PCIe SSD (SM951) for notebooks. It also recently unveiled the 850 Evo M.2 and 850 Evo mSATA SSDs for use in ultra-thin PCs.



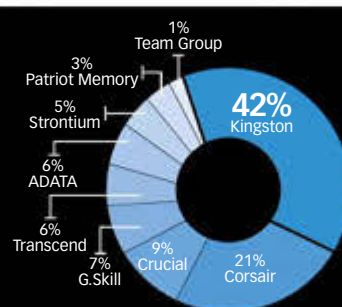
### Best Graphics Card Brand

With 44% of the votes, this is the sixth straight year ASUS has strolled away as the Best Graphics Card Brand. Once again, we think ASUS' popularity boils down to its ability to churn out a wide range of graphics cards for both NVIDIA and AMD fans.



### Best Motherboard Brand

What most of our readers like about graphics cards (variety, performance, reliability) also seem to apply to motherboards. As such, it's no wonder, that along with its graphics cards, ASUS also wins the Best Motherboard Brand award six years running, with an impressive 56% of votes.



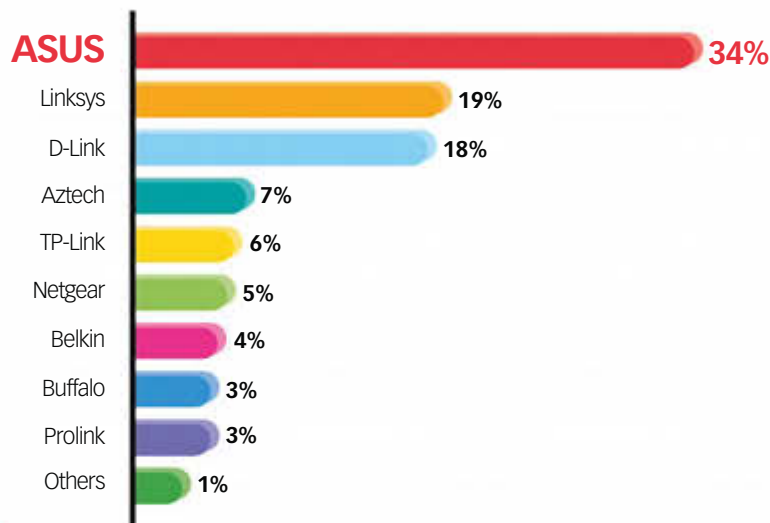
### Best PC Memory Brand

Another brand that has made an award its own is Kingston, who has won the Best PC Memory Brand award for the fifth consecutive year with 42% share of votes. Just this past January, its HyperX Predator DDR4 memory set a world record of 4,351MHz on an Intel X99-based MSI motherboard.



## Best Tablet Brand

Apple's iPad (which just turned five) remains your most beloved tablet with 57% of the votes. That's actually quite a feat if you consider that Apple only has two new tablets in 2014, the iPad Air 2 and iPad Mini 3. That said, it's also no secret that iPad sales have been shrinking for the past four quarters, and that 2015 is widely forecasted to be a bleak year for the whole tablet industry (IDC recently predicted a low single digit year-over-year growth). Can Apple overcome this "speed bump", perhaps with the help from the often rumored 12.9-inch iPad Pro? Only time will tell. Samsung, which shipped over 40 million tablets in 2014, takes second place with 17% of the votes.

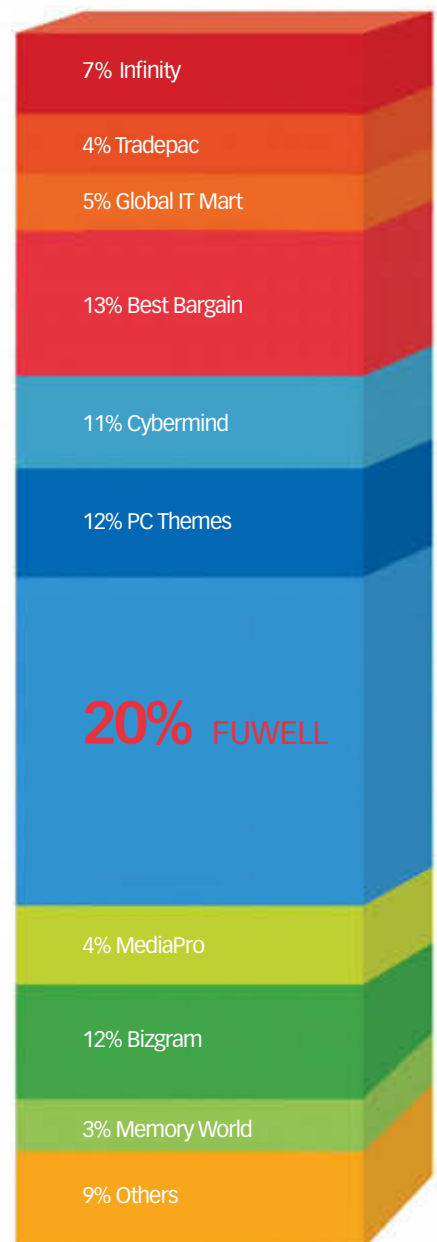


## Best Wireless Networking Brand

In the last few years, ASUS has not just proven that it's capable of making high-performance networking products, but that it can surpass that of traditional networking brands the likes of D-Link, Linksys and Netgear. In fact, if you look at the results of this year's voting exercise, ASUS alone carries 34% of the total votes and is the second straight year that they've won this award. Linksys, despite only recently returning to consumer networking, continues to bank on its name with 19% votes, while D-Link comes in a very close third at 18%.

## Best PC Components Retailer (Singapore)

Sim Lim Square has always been the go-to place for DIY enthusiasts building their own systems, as this is the mall that gathers numerous PC components retailers under the same roof. For the sixth consecutive year, you've voted Fuwell your favorite PC components retailer. Its 20% share is consistent with what it achieved last year. And its closest rivals this time are Best Bargain (13%), Bizgram and PC Themes (tie with 12% each).





**31%**  
SAMSUNG

**19%**  
PEBBLE

**11%**  
LG

**9%**  
SONY

**8%**  
MOTOROLA

**7%**  
GARMIN

**6%**  
ASUS

**5%**  
MICROSOFT

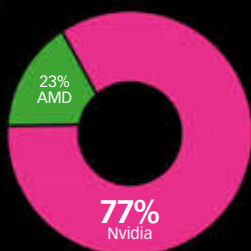
**2%**  
HUAWEI

**1%**  
TOMTOM

**1%**  
OTHERS

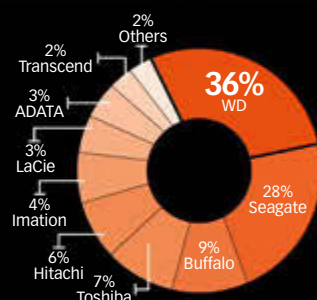
## Best Smartwatch Brand

According to the Smartwatch Group, Samsung is the current market leader in this space, having sold 1.2 million units of its Gear lineup in 2014, which translates to a market share of just above 17%. Since the Korean company has already gone through a few generations of smartwatch products in the last 16 months (its latest, the Gear S, has a curved 2-inch Super AMOLED display and runs on the Tizen OS), we aren't too surprised that many of you (31%) voted the Korean company your favorite smartwatch brand. Pebble, which recently announced the Pebble Time and Pebble Time Steel, is second with 19%. How will Apple fare next year, now that the Apple Watch is on its way? We shall see.



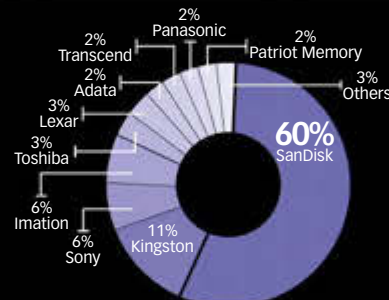
### Best GPU Brand

NVIDIA has been churning out card after card, technology after technology, from the Tegra K1 at CES 2014 to the 1st-gen and 2nd-gen Maxwells later in the year. We posit it's this constant stream of new products and performance improvements that keeps NVIDIA as your favorite GPU brand.



### Best External HDD Brand

When it comes to HDDs, there's no bigger brand than Seagate and WD. As such, it didn't come as a surprise to us that both companies grabbed the majority of the votes. With 36% of the votes, WD manages to retain the trophy it took home last year, while Seagate remains in second place with 28%.



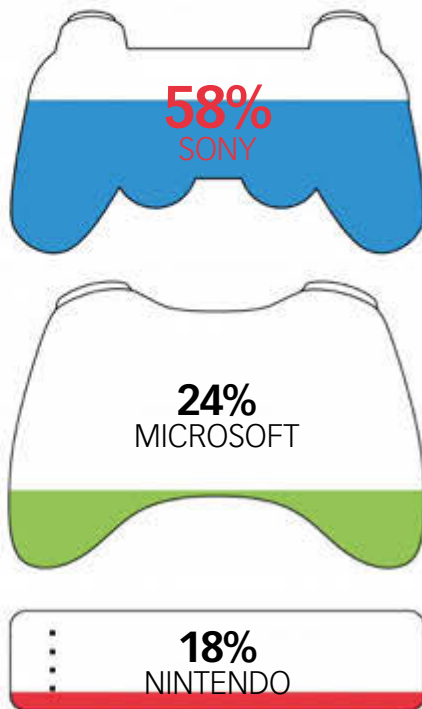
### Best Removable Flash Storage Brand

Thanks to its lion's share of the votes (60%), SanDisk once again wins Best Removable Flash Storage Brand. While it continues to invest in SSDs, it hasn't stopped innovating in the removable flash storage space. Case in point: its new 200GB microSD card.



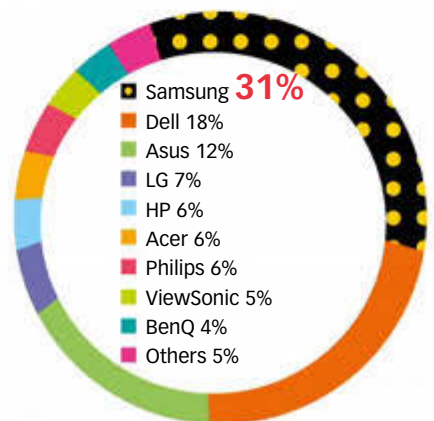
## Best Gaming Console Brand

Sony PlayStation 4 vs. Microsoft Xbox One. This is a battle that started even before both consoles came to market, is still on-going at the moment, and is expected to continue for at least a couple more years. Well, you've voted, and as the results show, the trophy is going home with the Japanese company.



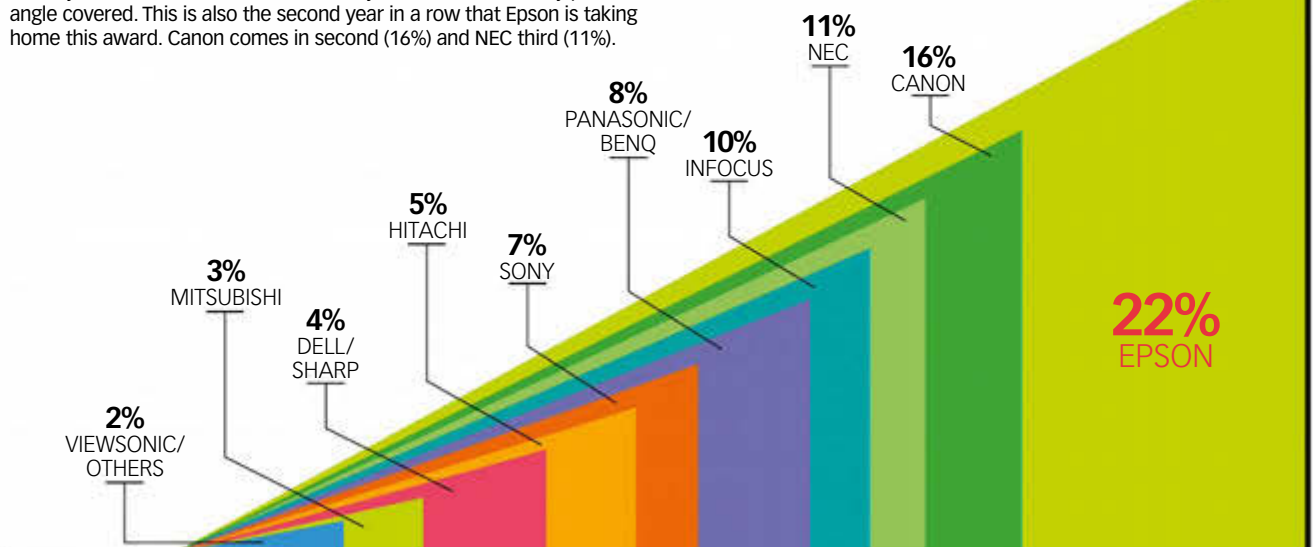
## Best Monitor Brand

With 31% of the votes, Samsung has done a 3-peat this year. Like its TVs, the Korean company continues to churn out new monitors on a frequent basis that covers just about every need you'll ever have. For example, just this March, it launched the SE790C, a 34-inch monitor with a 21:9 aspect ratio and a resolution of 3,440 x 1,440 pixels; as well as the SD590C, which stands at 27-inches and sports a full HD resolution. And we're expecting a few more, such as the UE950 and UE850 that support FreeSync, AMD's frame synchronization technology. And as we found out, the 28-inch UD590 of 2014 is pretty good if you're looking for a 4K monitor.



## Best Business Projector Brand

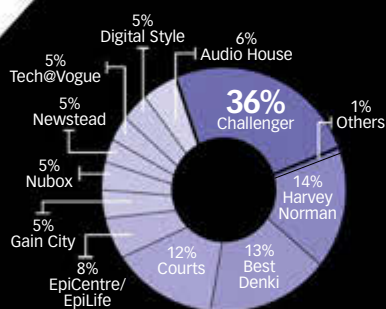
Those into projectors would probably know that according to market research firm Futuresource Consulting, Epson has been the world's number one selling projector brand for the last 14 years. And no wonder: be it high-powered projectors or interactive projectors, Epson, which just celebrated its 40th anniversary, seems to have every possible angle covered. This is also the second year in a row that Epson is taking home this award. Canon comes in second (16%) and NEC third (11%).





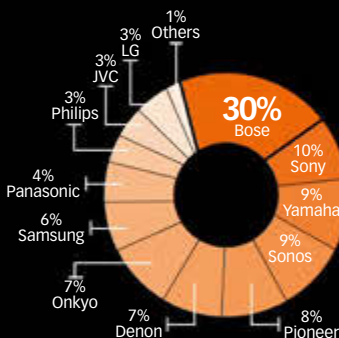
## Best Desktop PC Brand

A quick recap: Launched in mid-October last year, the iMac with 5K Retina display is one reason why Apple sold a record 5.5 million Macs in the December quarter. And this was the 34th time (out of the past 35 quarters) that Mac sales had outpaced PC sales. This time round, after tallying the votes, Apple remains your favorite desktop computer brand. Its 29% share of the votes is 10% more than second-place ASUS, which has 19%. HP (14%) and Dell (13%) aren't that far behind either. Can Windows 10, which is due to arrive sometime this summer, help other PC makers catch up to Apple in terms of sales and popularity? Let us check back next year.



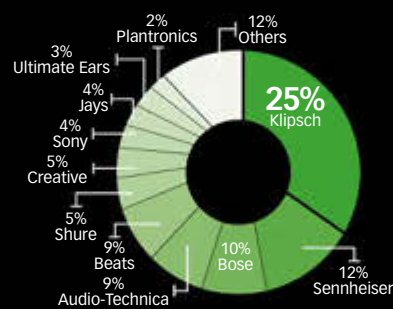
### Best CE Chain Store (Singapore)

With 36% of the votes, IT and CE chain store Challenger manages to hold on to the trophy it won last year. Harvey Norman (14%), Best Denki (13%), and Courts (12%) followed behind.



### Best Home Theater System Brand

For the fifth straight year, you've voted for Bose in this category. Its share of votes is more than second-place Sony (10%), third-place Yamaha (9%), and fourth-place Sonos (9%) combined.



### Best In-Ear Earphones Brand

Last year, Klipsch pipped Sennheiser to win this category, and it seems a good 25% of you still think so. Sennheiser comes in second with 12%. Bose completes the top three with 10%.

TEST

# LAB RESULTS

Every month behind the doors of our super secret gadget testing facility, the latest tech products are put through their paces using industry recognized benchmarks and our own blend of real world usage scenarios. Here are our findings.

## MORE INSIDE >

**ASUS ZENFONE 2**  
4GB RAM on a mainstream Android smartphone? Madness!

**FITBIT CHARGE HR**  
A stylish tracker, but is it accurate enough?

**SEAGATE SEVEN**  
The slimmest portable external HDD ever made.



## HOW WE RATE:

Products are rated on a scale of **1** to **10**; **1** being so abysmal, it should be a crime to sell it, and **10** being almost perfect. Come now, nothing is perfect. An Editor's Choice may also be awarded based on unique merits.





# COOLER, FASTER MAINSTREAM

With the NVIDIA GeForce GTX 960, gamers looking for faster performance and cooler temperatures can have their cake and eat it too. Here are three cards from ASUS, Gigabyte and MSI that take full advantage of the improved power efficiencies of the GM206 GPU with their own custom cooling solutions and frequency tweaks.

Text by *Koh Wanzl*

Photography by *Tan Wei Te + Zaphs Zhang*

Art Direction by *Ian Chong*



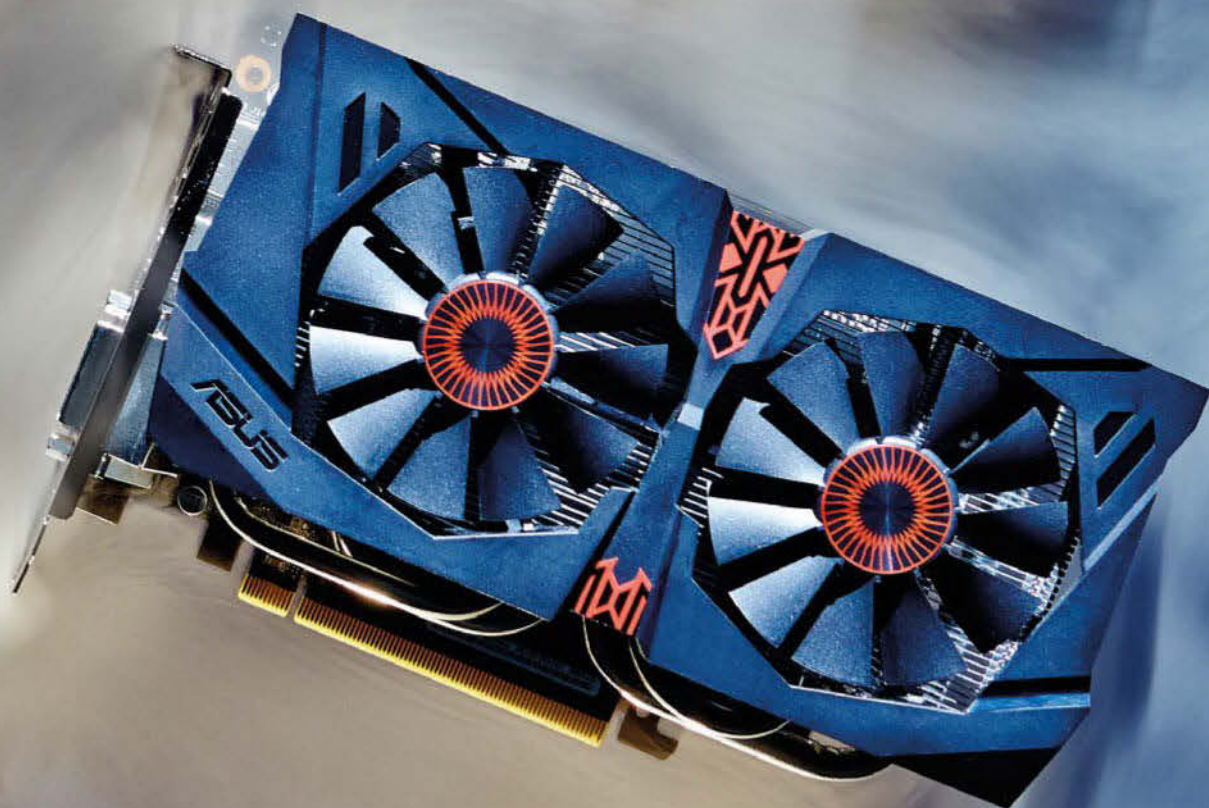
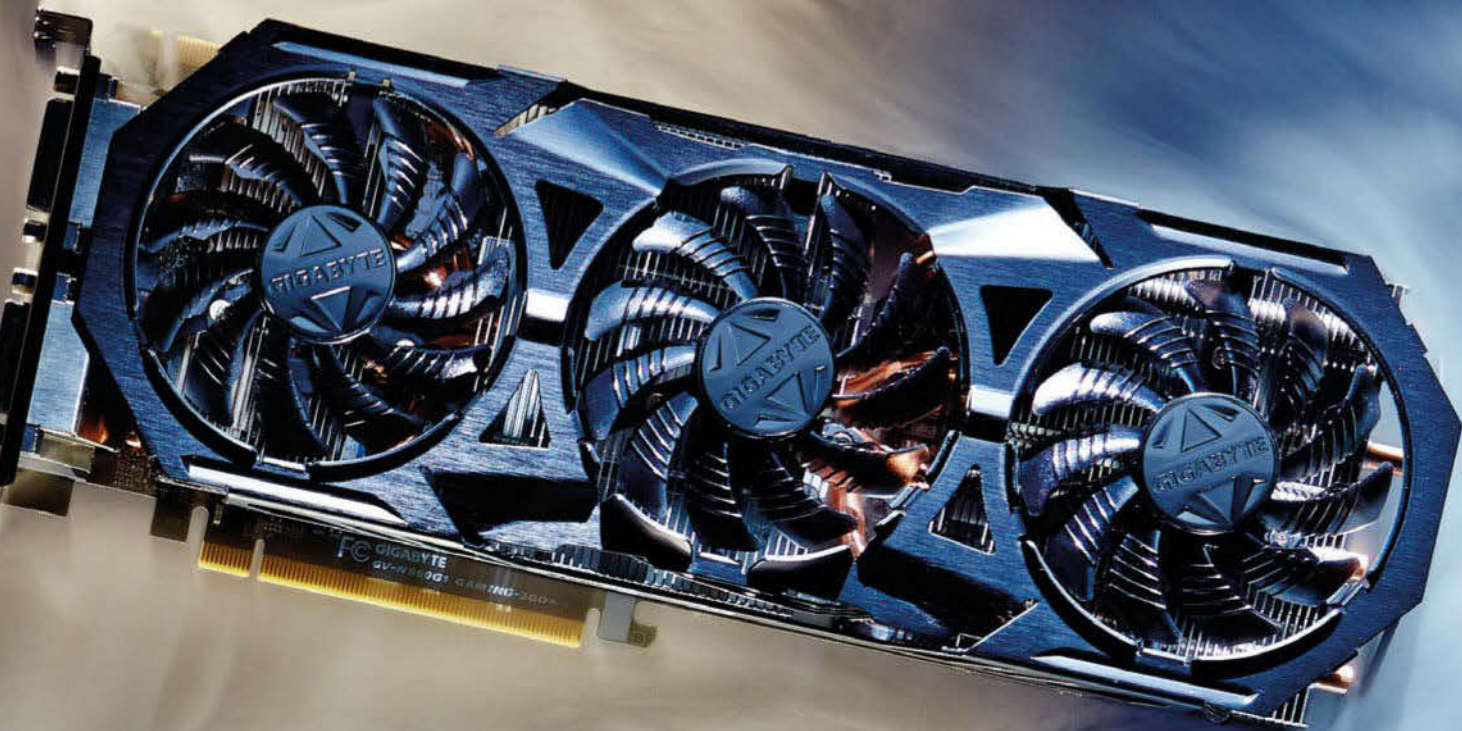
vs

ASUS STRIX GEFORCE  
GTX 960 OC ED.

GIGABYTE GEFORCE  
GTX 960 G1 GAMING

MSI GEFORCE GTX 960  
GAMING 2G





## ASUS STRIX GEFORCE GTX 960 OC ED.

When you look at the Strix GeForce GTX 960 OC Ed, it quite literally stares back at you. Its twin fans and black cooling shroud are styled to resemble a pair of piercing red eyes.

Its 5-phase power design system is driven by the usual Super Alloy Power (SAP) VRM components for smoother power delivery. However, there is also a dedicated SAP capacitor located behind the GM206 GPU

to further augment input stability, especially during overclocking. This is not visible though, because of the card's rear metal backplate, which provides extra rigidity and passive cooling for the card's PCB.

The heft of the cooling work is done by ASUS' DirectCU II cooling system with 0dB fan technology, which keeps its temperatures and noise levels down. The pair of cooling fans will stop spinning when the GPU core temperature is below 65°C, which means you should be able to enjoy silence during "light" gaming sessions. But when they are in operation, the fans cool the oversized aluminum heatsink with four embedded, 10mm heatpipes.

The card operates in OC mode by default, with slightly ratcheted up base clock speeds of 1,253MHz and boost clock of 1,317MHz.

The card also has a Gaming mode, with a rated base clock of 1,228MHz and boost clock of 1,291MHz. Gamers will be able to toggle between both modes using the ASUS' GPU Tweak software, ASUS own overclocking and monitoring utility that allows enthusiasts to adjust parameters such as clock speeds, voltages and fan speeds for maximum performance.

However, we noticed that the performance modes set by the "Power Saving" and "Overclocking" buttons in ASUS GPU Tweak do not conform to the official specifications of the card. For instance, the Power Saving button set the card's base clock speed to 1,204MHz and boost clock to 1,267MHz, which was lower than the speeds specified on paper. Only the Default button performed as expected, as enabling it puts the card in OC mode with operating frequencies that match the official specifications.

For video connectivity, the card features three DisplayPort outputs, one HDMI 2.0 port and one Dual-Link DVI-I connector. It is powered by a single 6-pin PCIe connector. An onboard LED indicator will turn white if the power cable is plugged in properly, which should help troubleshooting.

**+**  
Decent out-of-the-box performance.

**-**  
High operating temperatures and power draw. ASUS GPU Tweak profile settings do not match official specs.



### AT A GLANCE

#### GPU Transistors

2.94 billion

#### Core Clock

1,228MHz

#### Memory

2GB GDDR5

#### Memory Clock (DDR)

7,200MHz

#### Price

\$369



The card's four 10mm heatpipes are the thickest of the lot and serve to draw heat away from the GM206 GPU.



The solid metal backplate of the ASUS card provides protection and passive cooling for the PCB.



The card can be powered by just a single 6-pin PCIe power connector.



## GIGABYTE GEFORCE GTX 960 G1 GAMING

The Gigabyte GeForce GTX 960 G1 Gaming is clearly a card that is serious about cooling. Its Windforce 3x cooling system comprises three cooling fans and a black cooling shroud and heatsink. No thanks to the three-fan design though, it is the longest card in the line-up, measuring 295mm in length as compared to the 215.2mm ASUS and 267mm MSI, so make sure your case has enough clearance.

The card's out-of-the-box clock speeds sit right in the middle of the pack at a 1,241MHz base and 1,304MHz boost. It is the only card to not feature alternative operating profiles for quick clock speed adjustments. Like the ASUS, it also has a metal backplate that provides structural support and passive PCB cooling. The backplate is perforated in places, with cutouts that have been arranged to fan out from the center, exposing the capacitors located directly behind the GM206 GPU (these were all hidden under the backplate of the ASUS card).

The fan shroud also has LED lighting that helpfully indicates the operating status of the fans, where the "Silent" and "Stop" indicators will light up when the cooling fans

stop spinning under low-load conditions. The Windforce 3x cooler is equipped with pure copper heatpipes that are in direct contact with the GPU, which helps improve heat dissipation. The 11-blade fans have striations down their flat side, and are designed to improve cooling while reducing air turbulence around the blades and bring about lower noise levels.

And unlike the other two cards though, the GeForce GTX 960 G1 Gaming will require two 6-pin PCIe power connectors. The Gigabyte card also sports an additional dual-link DVI-D port, in addition to a dual-link DVI-I port, HDMI 2.0 port and three DisplayPort connectors. This card supports Gigabyte's Flex Display technology, which allows users to have more options when they opt for multi-display configurations. Some gamers may not own multiple displays with DisplayPort connectivity,

and the additional DVI-D port on the Gigabyte card will still allow these gamers to enjoy a "4K surround" experience with a pair of displays with DVI outputs and another that supports DisplayPort technology. But for a full "4K surround" experience, three DisplayPort displays are still required.

**+**  
**Good performance despite not having the highest clock speeds.**

**-**  
**May not fit in smaller PC cases due to its long length.**

### AT A GLANCE

#### GPU Transistors

2.94 billion

#### Core Clock

1,241MHz

#### Memory

2GB GDDR5

#### Memory Clock (DDR)

7,010MHz

#### Price

\$399



The card features an additional dual-link DVI-D connector for support of Gigabyte's Flex Display technology.



The perforated metal backplate features a cutout that exposes the capacitors located behind the card's GM206 GPU.



The Windforce 3x cooling system makes this the longest card in the line-up.



## MSI GEFORCE GTX 960 GAMING 2G

The MSI GeForce GTX 960 Gaming 2G stands out with the aggressive design of its cooling shroud, which is black with bold accents of red that practically ooze gamer cred. Diving under the hood, the card has a default base clock speed of 1,216MHz and a boost clock of 1,279MHz. In fact, its overclocked profile is the least aggressive among the three cards compared here. The card ships with three official operating modes; in OC mode, its GPU core operates at 1,241MHz (boost clock speed: 1,304MHz), in Gaming mode, its base clock speed is 1,190MHz (boost clock speed: 1,253MHz), and in Silent mode, the card runs at 1,127MHz (boost clock speed: 1,178MHz). Its 2GB of GDDR5 video memory is set at 7,010MHz regardless of the active mode.

MSI's Twin Frozr V cooling system here sports dual 100mm Torx fans over a nickel-coated GPU heatsink based on MSI's SuperSU architecture. According to MSI, the GPU heatsink is connected to 8mm-thick heat pipes, which are laid out for more efficient heat dissipation by reducing the length of unused heat pipe.

Like the ASUS and Gigabyte card, MSI's

Zero Frozr technology stops the fans from spinning in low-load situations for quieter operation. Uniquely, Torx fans are able to spin independently of each other, which should help further manage noise even when active cooling is required. With the MSI Gaming App, you can control the LED lighting of the MSI Gaming dragon insignia through

a total of five operational modes. The app also lets you toggle between the three performance profiles and customize your screen's display profile with its Eye Rest feature.

However, the MSI is the only card to lack a rear backplate, which helps the card maintain a thin, less-than two-slot profile. The card is just 36mm thick, as compared to 40.9mm for the ASUS card and 43mm for the Gigabyte. Gamers intending to run these cards

in SLI will probably appreciate the resulting extra clearance and airflow, although some users may still miss the extra rigidity and protection that a backplate offers. Finally, on the video connectivity front, the card has three DisplayPort ports, an HDMI 2.0 port, and a dual-link DVI-I port. It is powered by a single 8-pin PCIe connector.



**Twin Frozr V cooler succeeds in cooling the card quite well.**



**Lacks the structural support of a metal backplate.**



### AT A GLANCE

#### GPU Transistors

2.94 billion

#### Core Clock

1,127MHz

#### Memory

2GB GDDR5

#### Memory Clock (DDR)

7,010MHz

#### Price

\$369



The card does not have a metal backplate and features an exposed PCB for a slimmer profile.



The 100mm Torx fans are able to operate independently and will stop spinning when the GPU's load falls below a certain threshold.

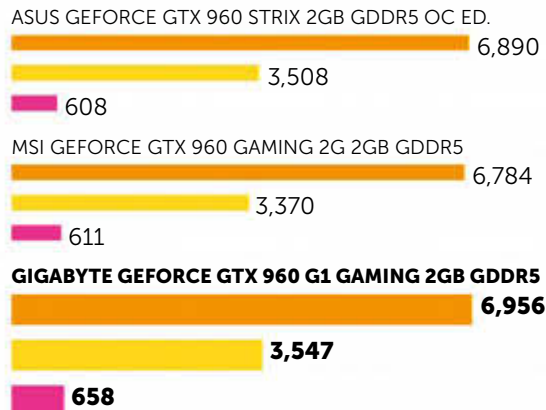


The card has three DisplayPort connectors, one HDMI 2.0 port, and a dual-link DVI-I port.

## 3D Mark 2013

(3D Marks, higher is better)

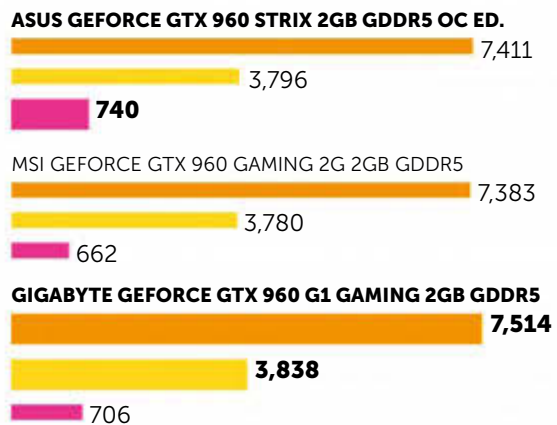
The ASUS GTX 960 OC Ed. card was expected to be the winner in our gaming benchmarks as it rolled off the factory floors with the most aggressive OC profile. However, it was instead the Gigabyte card that pulled ahead most of the time. And although the MSI card sits behind its ASUS and Gigabyte counterparts, the performance differential is not too significant.



## Overclocking

(3D Marks, higher is better)

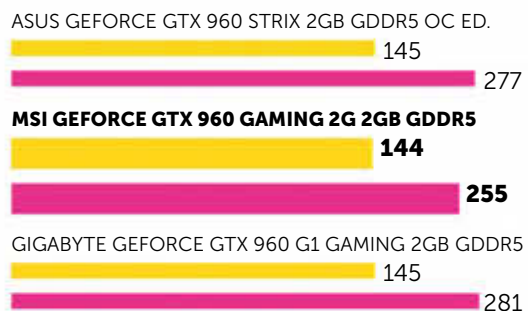
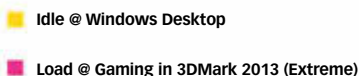
The Gigabyte card was the clear winner while the ASUS card was the runner-up. We managed to overclock the winning card to a high of 1,341MHz for its base clock. In its overclocked state, its boost clock speed was 1,404MHz. Its memory modules were overclocked to a high of 7,620MHz, which was about 8% higher than the default 7,010MHz. Despite reaching higher overclocked speeds than the Gigabyte card, the ASUS card trailed behind as its memory modules could only be pushed to 7,556MHz, about 1% lower than the Gigabyte.



## Power Consumption

(Watts, lower is better)

The MSI card had the lowest power draw of 255W under load. ASUS and Gigabyte weren't as efficient here, which is to be expected because they operate at higher clock speeds.



## Temperature

(Degrees Celsius, lower is better)

The Twin Frozr V cooling system on the MSI card managed to keep the GM206 graphics core of the MSI card running coolest at 57°C, probably due in part to its base clock speed of 1,216MHz, which was the lowest among all three cards. The Gigabyte card also performs fairly well at 59°C, considering its higher clock speeds.





# T E S T - NVIDIA GEFORCE GTX 960 SHOOTOUT



MODEL	ASUS STRIX GEFORCE GTX 960 OC ED.	GIGABYTE GEFORCE GTX 960 G1 GAMING	MSI GEFORCE GTX 960 GAMING 2G
CORE CODE	GM206 (28nm)	GM206 (28nm)	GM206 (28nm)
GPU TRANSISTOR COUNT	2.94 billion	2.94 billion	2.94 billion
CORE CLOCK SPEED	Gaming mode: 1,228MHz (Boost clock: 1,291MHz) OC mode: 1,253MHz (Boost clock: 1,317MHz)	1,241MHz (Boost clock: 1,304MHz)	Silent mode: 1127MHz (Boost clock: 1178MHz) Gaming mode: 1190MHz (Boost clock: 1253MHz) OC mode: 1241MHz (Boost clock: 1304MHz)
STREAM PROCESSING UNITS	1,024	1,024	1,024
TEXTURE MAPPING UNITS (TMU)	64	64	64
RASTER OPERATOR UNITS (ROP)	32	32	32
MEMORY	2GB GDDR5	2GB GDDR5	2GB GDDR5
MEMORY CLOCK SPEED (GDDR5)	7,200MHz	7,010MHz	7,010MHz
MEMORY BUS WIDTH	128-bit	128-bit	128-bit
MEMORY BANDWIDTH	115.20GB/s	112.16GB/s	112.16GB/s
PCI EXPRESS INTERFACE	PCIe v3.0 x16	PCIe v3.0 x16	PCIe v3.0 x16
VIDEO PORTS	1 x dual-link DVI-D, 1 x HDMI 2.0, 3 x DisplayPort	1 x dual-link DVI-D, 1 x dual-link DVI-I, 1 x HDMI 2.0, 3 x DisplayPort	1 x dual-link DVI-D, 1 x HDMI 2.0, 3 x DisplayPort
HDCP OUTPUT SUPPORT	Yes	Yes	Yes
PRICE	\$369	\$399	\$369

# AND THE BEST GEFORCE GTX 960 GRAPHICS CARD IS



## MSI GEFORCE GTX 960 GAMING 2G

If you base on our benchmarks, the Gigabyte GeForce GTX 960 G1 Gaming did well in both performance and overclocking. However, since we're looking at mainstream gaming here, the MSI GeForce GTX 960 Gaming 2G has a better overall proposition based on its attractive price point, consistent performance and most importantly lower temperatures and power draw. Its stellar Twin Frozr V cooler design proved to be the most dynamic cooling solution of the lot. In the end, it was the only card to hit all the right checkmarks for what a custom GeForce GTX 960 graphics card should be.

# ALL-ROUND GAMING KEYBOARDS

No matter how you look at it, a keyboard is as essential a part to PC gaming as a graphics card. You can have the latest hardware to run games, but what good is it if you're not enjoying the experience? Gaming is as much a tactile experience (hence the popularity of rumble feedback) as it is visually, which is why we're following up last issue's gaming mouse shootout with a mechanical keyboard one.

Text by *Salehuddin Husin*

Photography by *Tan Wei Te + Zaphs Zhang*

Art Direction by *Ian Chong*





**vs**

ASUS STRIX TACTIC PRO

• LOGITECH G910

ORION SPARK

• RAZER BLACKWIDOW

CHROMA

• ROCCAT RYOS TKL PRO



## ASUS STRIX TACTIC PRO

The ASUS Strix Tactic Pro is an anomaly in the ASUS stable as it's one of the more expensive peripherals they've produced, overshadowing even its own premium ROG brand. It is the second most expensive keyboard in this shootout and the heaviest of the lot. It's big, it's firm and it's overflowing with macro keys.

You've macros under your thumbs, two whole rows of macros on the left and even the F1 to F12 keys also double as macros. If you're an MMO player, this keyboard should be right up your alley. To top it off, it also has physical media keys and a neat little volume roll bar. You'll see this in the Logitech G910 as well, though the one on the Tactic Pro is a bit stiffer with less give. To manage all these keys, ASUS throws in a great configuration utility that's pretty functional.

While it seems impressive, at first, the excessive number keys make the keyboard a little awkward to use. Our left hand had quite the workout, which was especially discomforting when you cannot afford to lift your finger off the WASD keys while gaming. Then there are the thumb

macros. The Roccat is the other keyboard that has this feature, and both feel off.

Perhaps one of the reasons is because the Tactic Pro doesn't have a wrist rest and comes with very short stands. Our thumbs and fingers always felt like they had to travel more than they had to, to reach the intended keys. One consolation, the Tactic Pro

thumb buttons were better raised and rounded, which helped identify what we were pressing.

Our review Tactic Pro uses Cherry MX Red switches though its product page shows that you can get them in any of the other Cherry MX colors as well.

The Strix Tactic Pro is a solid gaming mechanical keyboard, but we felt that ASUS may have gone a little too far in trying to put as many macro keys on it as possible. While they were functional and a boon for MMO players, its implementation requires

a learning curve where you'd initially have to keep glancing down to see if you're pressing the right keys. As the largest keyboard here, it also means your fingers having to travel longer distances.



**Tons of customization.**  
**Solid build.**  
**Distinguishable thumb buttons.**



**Awkward to use.**  
**Huge.**



### AT A GLANCE

#### Switch

Cherry MX Red

#### Dimensions

564 x 240 x 85mm

#### Weight

2.3kg

#### Price

\$219



The Volume roll bar is stepped, like a mouse wheel.



Thumb buttons are of different shapes and sizes, easily distinguishable by feel.



Two rows of macro keys at the sides make the Tactic Pro the longest keyboard here.

## LOGITECH G910 ORION SPARK

We reviewed the G910 Orion Spark on its own back in April, so here's a short recap. The G910 is one of the few mechanical keyboards around that doesn't use any of the popular mass produced switches from Topre or Cherry. Instead Logitech uses their own design dubbed Romer G, which they claim to be faster than conventional mechanical switches.

They're pretty similar to Cherry Brown keys, though they have a bit more resistance to them. While Browns are easily depressed, you need a bit more force to push down Romer G keys. Romer G stem and keycaps are also proprietary. The square stems allow more light to pass through, which makes the G910's keys brighter than the other keyboards in the shootout. On top of that, its keycaps are concaved, with angled sides that lead your finger right to the middle of the button, and it actually does work once you get used to them.

The G910 also has an Arx Dock, which is just a fancy name for a smart device holder. It's a small inclusion but it's unique and useful. Both tablets and phones can be

slotted in and removed without issue so you can easily use your smart device as a second screen to display guides or videos when you're gaming.

Like the ASUS Strix Tactic Pro, the G910 has quite a bit of macro and shortcut keys going on. However, unlike the ASUS, Logitech's tries to fit them around existing keys for easier access. For example, instead of two rows of macros to the far left like the ASUS, the G910 has just one row, while the second row of four keys is located above F1-F4. With this setup, both rows of macros (Logitech calls them G-keys) are within easier reach without either overstretching our fingers or having to lift up and move our hand to press a macro key.

The downside to the G910 is mainly due to its price. At \$249, it's the most expensive keyboard in this shootout

and a serious investment for any gamer considering that it uses its own custom switch design, which limits off-the-shelf replacement parts. Plus, for this price, we expected better materials used. Its use of plastic keeps it lightweight enough, but we'd have liked a little more heft.

  
**Arx Dock has its uses. Smooth volume roll bar.**

  
**Custom switch might be troublesome to repair. Expensive.**



### AT A GLANCE

#### Switch

Logitech Romer G

#### Dimensions

505 x 210 x 35.5mm

#### Weight

1.5kg

#### Price

\$249



The Arx Dock is basically a fancy tablet or phone holder.



The Orion Spark does have a set of macro buttons at the side, though nowhere near the amount present in the Strix Tactic Pro.



The specialized Romer G keys have a square stem, instead of the round Topre stems or the + Cherry stems.



## RAZER BLACKWIDOW CHROMA

The BlackWidow Chroma is another keyboard in Razer's much loved BlackWidow line. It does feature some design tweaks but the main features here are the gorgeous backlights that cycle colors as you type. You can configure them to do other things too if you prefer, or find it too distracting. The backlights fill the whole keyboard; not only are the keys illuminated, the spaces in between them are too, which makes for a really cool effect.

The keyboard also has the longest stands among the rest, which we love. However, they aren't adjustable, so if you're not sure you are comfortable with such a steep angle, you might want to try out the Chroma at a shop first.

The Chroma is the other keyboard that uses custom mechanical switches and like Logitech, Razer also claims to have superior capabilities compared to your standard switches. Having used the Chroma for a while, we'd say they are a cross between Logitech's Romer G and Cherry MX Browns. They're not as heavy as the Romer G, but don't have the springy

nature of the Cherry MX Browns. It's great for typing and playing but it is significantly noisier. Buying rubber rings might not be a bad idea if you're planning on using the Chroma in the office. Unlike Logitech though, the Chroma is compatible with standard Cherry keycaps.

**+**  
**Great looks and feel. Custom switches with Cherry stems. USB port and audio jacks built-in.**

**—**  
**Noisy. No wrist rest. Weak indicator lights.**

Key layout is very minimalist and after playing with both the ASUS and Logitech, it may not be a bad thing. Otherwise, it does offer fully programmable keys, anti-ghosting features and on-the-fly macro recording.

The keyboard can also serve as a pass-through, as it has audio jacks and a USB port on the side. It's great except the keyboard uses two USB 2.0 ports (or one USB 3.0) on whatever machine you're connecting it to. Since it has audio pass-through capability too, that means you also get two more cables (for the audio) on top of the two USB cables. As the cables aren't detachable, it can get a bit messy.

Minor gripes aside, the BlackWidow isn't that bad of a keyboard. It's not flawless but it's far from being the worse mechanical keyboard out right now.

### AT A GLANCE

#### Switch

Razer Mechanical Switch

#### Dimensions

475 x 171 x 39mm

#### Weight

1.5kg

#### Price

\$159.90



The extra macro column is the only standout in an otherwise generic design.



The backlights are just under the keycaps, filling in the spaces between them.



The BlackWidow is the only keyboard with audio pass-through.



## ROCCAT RYOS TKL PRO

The RYOS TKL Pro is the latest in Roccat's line of mechanical keyboards. The one we have is using Cherry MX Red switches, though Roccat also offers the keyboard in different Cherry varieties.

For gamers who don't have lots of space, the RYOS TKL Pro is a great option. It might be missing a Numpad (which makes entering numbers a chore) but the Easy Shift [+] function more than makes up for it since they effectively double the available keys you can map shortcuts and functions to. If you have a Roccat mouse with Easy Shift [+], you can easily pair it with the keyboard. When paired, you can use either peripheral's Easy Shift [+] button, to toggle the alternate commands.

Per-key illumination sure seems cool on paper too, but using it is another thing. The top row of the keyboard (from ESC to Break), WASD and arrow keys are constantly illuminated; the rest fade in and out as you use them. It really defeats the purpose of having backlights in the first

place since you need to hit the keys to light them up. Also, we've encountered weird issues where sometimes they don't turn on after you hit a key, while other times they seem to linger longer than usual.

Like the ASUS, there are extra macros below the spacebar. Roccat calls theirs 'Thumbster' keys, and like ASUS, we still felt they were awkward to actually make use of. Otherwise, the RYOS TKL Pro was actually one of the most comfortable keyboards to use due to its jumbo wrist rest. Despite being made of plastic, it does its job well, is stable and smooth enough to allow sliding of our wrists while typing without any issues.

The Roccat RYOS TKL Pro might be the shortest and lightest keyboard in this shootout because of its Ten Key Less design, but by no means does it shortchange gamers in terms of available customization. Roccat's Easy Shift [+] is still probably the

most elegant manner of increasing available keys used for macros, resulting in much more usable keys than most.



**Easy Shift [+] doubles available keys. Great tactile response from switches. Large integrated wrist rest. Can pair with Roccat mouse with Easy Shift [+] key.**



**TKL means the loss of the Numpad. Per key illumination doesn't work right.**



### AT A GLANCE

#### Switch

Cherry MX Red

#### Dimensions

404 x 233 x 33mm

#### Weight

1.25kg

#### Price

\$189



The Thumbster buttons are a good idea, though they're too flat and similar to tell them apart by touch alone.



The jumbo wrist rest might look out of place since the RYOS is a TKL keyboard, but it is very comfortable.



LED indicators are squared away beside the Enter key, which makes them a bit hard to read at a glance.



MODEL	ASUS STRIX TACTIC PRO	LOGITECH G910 ORION SPARK	RAZER BLACKWIDOW CHROMA	ROCCAT RYOS TKL PRO
SWITCH	Cherry MX Red	Romer G	Razer Mechanical Switch	Cherry MX Red
DIMENSIONS	564 x 240 x 85mm	505 x 210 x 35.5mm	475 x 171 x 39mm	404 x 233 x 33mm
WEIGHT	2.3kg	1.5kg	1.5kg	1.25kg
ACTUATION FORCE	45cN	45cN	50cN	45cN
PRICE	\$219	\$249	\$159.90	\$189

## THE FORCE BEHIND THE SWITCHES: TOPRE AND CHERRY

If you're done research and read up on mechanical keyboards, Topre and Cherry keys are mentioned everywhere. But where exactly do they come from?

Topre switches come from a Japanese company called Topre. Topre switches feature incredibly low actuation points, which mean even the slightest pressure, can trigger the switch. Their lowest actuation point is 30cN, and their highest at 55cN. Their stems also differ from the Cherry ones in that they're rounded. Topre keycaps are supposedly more stable due to this.

Cherry Corporation is the company behind the Cherry switches. While the corporation has been bought over and is now part of the ZF Electronics conglomerate, the company still uses its name and branding on its products. Cherry keys, like Topre keys, come in a multiple varieties, with the most famous being the Red and Brown Cherry MX keys. Cherry keys have higher actuation points than their Topre counterparts. The lowest actuation point is 45cN, found only on the Cherry MX Brown and Red switches. Their highest actuation point is 70cN, found exclusively on the rare Cherry MX Green switch. Cherry stems are + shaped, which can sometimes lead to the keys being stuck if hit wrongly.

## NOT ALL KEYCAPS ARE CREATED EQUAL

When choosing a mechanical keyboard, the type of switch used in it isn't the only thing worth noting. The keycaps themselves can play a big role on how comfortable a keyboard can be. There are four types of keycap printing methods (detailed on the right), each with their own pros and cons.



The fonts on the keycaps are also different.

**Pad Printing:** The most common. Pad printed letters are like stickers placed on top of the keycaps.

- + Low cost
- + Easy to use multiple colors on a single keycap
- The printing sticks out
- Wears out fast

**Laser Etching/ Engraving:** Lasers or other instruments are used to burn/ carve in the letters on the keycaps.

- + Lasts a long time
- + Unique look
- Can feel grooves if not done properly

**Dye Sublimation:** The lettering is formed using a dye, which seeps into the plastic keycap.

- + Lasts a long time
- + No grooves or inconsistencies
- Expensive process
- Only able to print letters darker than the plastic

**Double-Shot Injection molding:** A two-step process in which a legend is first molded in plastic. The insert created is then put into another mold, while another piece of plastic is inserted under it and combined using heat.

- + Zero wear
- + No feel
- Expensive
- Rare



# AND THE BEST MECHANICAL GAMING KEYBOARD IS



## ROCCAT RYOS TKL PRO

The Roccat RYOS TKL Pro gets our nod of approval here, though it was a close race with the Logitech G910 Orion Spark. In the end, the Roccat keyboard won us over. If the Romer G system changed the game significantly, it would've been another matter, but the truth is other than the stem and keycaps, the Romer G switches feel similar to Cherry MX ones. On top of that, getting replacements for the keys might prove problematic since the switches are proprietary.

Gimmicky lighting aside, what really did it for the RYOS TKL Pro is the Easy Shift [+] function. Custom physical keys are fine and dandy, but they take up space on a keyboard. The Easy Shift [+] function only takes up one key and makes every other key have an alternate function without adding more stuff. It might be the smallest and lightest keyboard in our shootout, but it offers the most in terms of performance, customization and comfort. In this case, lesser is indeed more.

# POSSIBLY THE WORLD'S SEXIEST PORTABLE HDD

## Seagate Seven

### AT A GLANCE

**Capacity**  
500GB

**Interface**  
USB 3.0

**Weight**  
178g

**Price**  
\$199



A LED indicator on the front panel lets users know the drive is working.

### CONCLUSION

**The Seagate Seven is stunning, but offers lackluster performance and is extremely pricey.**

TESTED & RATED

**7.0**<sub>/10</sub>

**HWM**  
SINGAPORE

To celebrate Seagate's 35th anniversary, the company unveiled its sexy new Seven portable external hard disk drive at CES 2015 earlier this year.

The Seagate Seven features a distinctive design is that at the same time both retro yet modern. But more importantly, it measures just 7mm thick and weighs 178g. This is possible because the hard disk drive within is only 5mm thick. This also means that the brushed stainless steel case that it is encased within is just 2mm thick. Despite this, the Seagate

Seven feels sturdy and strong and never once felt flimsy.

To be honest, thin 5mm hard disk drives are not a novelty; they were launched over two years and were initially designed to enable manufacturers to come up with high capacity storage tablets. Unfortunately, this did not come to pass as manufacturers stuck with NAND memory for their performance. It also helped that prices of NAND memory has fallen quite drastically in the past few years.

Back to the Seagate Seven, and it is worth noting that at

this point, that because of its design and the fact that it is a mechanical HDD, it is limited to only 500GB in capacity.

Performance from the Seagate Seven is decent, but we noticed in our testing that write speeds are a little below average by around 10% when compared to regular portable external hard disk drives. Again, this stems from the fact that the drive was designed for aesthetics first, rather than storage or performance.

Like most Seagate drives, it comes preloaded with the Seagate Dashboard utility for PCs and Macs. Apart from system backups, Dashboard also features integration with social media services like Facebook and Flickr and can be programmed to automatically backup your photos to the cloud. There's a new feature called Mobile backup that can even protect data on your iOS or Android device. That said, you don't need to use Dashboard. You can pair it with your own backup utility and Mac users can use the drive instantly with Time Machine.

The biggest problem with the Seagate Seven is its price-per-GB. Yes, its slimness is an engineering marvel, but for \$199, you could very well get a proper 2TB drive and they aren't all that hefty to begin with. Seagate's own 2TB Backup Plus Slim for example is actually lighter than the Seagate Seven at 159g. In the end, the Seagate Seven is more of a commemorative collector's edition rather than something you'll actually need for serious storage purposes.

by *Kenny Yeo*





#### AT A GLANCE

##### Power source

Tough Solar power system

##### Water resistance

100 meters

##### Dimensions

51.1 x 46.1 x 14.7mm

##### Weight

106g

##### Price

From \$2,799



An advanced shadow-dispersing solar panel covers the whole watch face, but can you see it?

#### CONCLUSION

**A premium timepiece that commands a premium price, the OCW-G1000 brings tech sophistication into the old-school analog wristwatch.**

# GEEK GENTRIFICATION

## Casio Oceanus OCW-G1000

Casio is probably most well-known for its G-Shock watches that are relatively cheap, high indestructible and command a cultural following that cannot be denied. They're as much a fashion accessory as they are utilitarian.

Back in January, we reviewed the G-Shock GPW-1000, the first watch to feature Casio's Hybrid Wave Ceptor technology, which includes both radio and GPS receivers for time adjustment, arguably more advanced than the GPS-only Seiko Astron or Citizen Satellite Wave. At \$999, the GPW-1000 was also a steal, but it was still a chunky plastic G-Shock, while the Seiko Astron is more elegant with stainless steel and titanium variants.

Casio's answer is their ultra-premium Oceanus range, some of the few watches that are still fully assembled in Casio's Yamagata factory in Japan, and hand-finished by certified artisan watchmakers. Because of this, only a limited quantity can be produced each month. The newest model, the OCW-G1000 now

features that same Hybrid Wave Ceptor technology.

In terms of craftsmanship, its band, case and bezel are made of titanium with two hardening treatment finishes: titanium carbide (silver) and diamond-like-carbon (black). Its bezel is polished to a mirror shine via Sallaz polishing, and its crystal is dual-curved sapphire glass with anti-reflective coating on both sides. The end-result is a gorgeous marriage of the fine brushed metal look of the case and band with the clear, polished shine of the bezel and crystal.

For an analog watch, the OCW-G1000's movements are quite impressive with independent motors for each dial. We're talking about dual world time dials, an AM/PM dial, auto-calendar with day and date display, plus a 24-hour chronograph. Also don't discount space needed for the radio/gps module, battery and solar panel; all in a case that's just 46.1mm wide and 14.7mm thick, with the whole watch practically featherlight at a mere 106g.

Watch operation is almost identical to the GPW-1000 as it uses the

same GPS module. The only adjustments you need is the setting of home cities on the main or sub world time dials when traveling. Otherwise, it corrects time on its own just fine, but you can initiate manual syncing too. Casio claims up to 18-months of battery on a full charge, but unless you're a vampire and don't plan on stepping into sunlight at all, this should never be a problem.

A word of warning though, wearing the OCW-G1000 had an effect of eroding my inner nerdy man-child. With thoughts of bespoke clothing and artisanal beverages of the shaken, not stirred kind, I dare say it made me feel like a proper adult, digital smartwatches be damned.

by Zachary Chan

TESTED & RATED

**9.0**<sub>/10</sub>

**HWM**  
SINGAPORE





## AT A GLANCE

**OS**

Android 5.0 Lollipop

**Display**

5.5-inch 1,920 x 1,080 pixels (403ppi) IPS LCD

**Processor**Intel Atom Z3580  
2.3GHz**Storage**32GB internal storage  
(microSD support up to 64GB)**Price**

\$429



The rear of the ZenFone 2 has a new brushed metallic finish.

# THE MAINSTREAM 4GB WONDER

## ASUS ZenFone 2

Last year, ASUS launched the ZenFone 4, ZenFone 5, and ZenFone 6. This year, we have the ZenFone 2. If that sounds like a step backwards, allow us to explain. Last year's ZenFone came in three screen sizes: 4-inch, 5-inch, and 6-inch (thus, 4, 5, 6). This year's ZenFone ditches the screen size naming and is so called because it's the true second-generation ZenFone.

Glad to have cleared that up? There's just a few more things to take note before we actually get into the review. The ZenFone 2 is actually available in two different screen sizes: 5-inch and 5.5-inch. The 5.5-inch model is available in either Full HD

or 720p options. And the Full HD version comes in either 2GB RAM or 4GB RAM with a faster processor. And the 4GB RAM model can be had in 32GB or 64GB storage. All these variants fall collectively under the same ZenFone 2 umbrella, so you will have to look at the individual product codes to identify which is which.

Clearly, there will be price and performance differences depending on the model you purchase, but for this review, we'll look at the top-tier variant: the 32GB Full HD 5.5-inch ZenFone 2 with 4GB RAM (ZE551ML). Design-wise, the ZenFone 2 looks much the same as its predecessor. The rear of the phone is

ergonomically curved (it's actually slightly more curved than last year's ZenFone) and fits comfortably into the palm of your hand, letting you keep a firm grip. While the phone is a bit heavier and thicker than many flagship phones these days, it's still relatively compact and light for a mid-range handset.

While the phone is still entirely plastic, ASUS has introduced a brushed metallic finish to the phone's removable back cover, which looks fairly convincing (at least at arm's length). Removing the back cover reveals two micro-SIM slots and one microSD card slot. The ZenFone 2 supports Cat4 LTE, which provides



Like LG's flagship phones, the ZenFone 2 has rear volume buttons.

#### CONCLUSION

**When specs and performance count more than a fancy build, the ZenFone 2 is an excellent choice for anyone on a budget. Just choose wisely.**

data transfer rates up till 150Mbps. However, unlike its predecessor, only one SIM card slot supports data transmission - the other slot is for calls only.

The most noticeable design change for the ZenFone 2 is that the volume rocker has been moved to the rear of the device, similar to LG's flagship phones. On LG's phones, the power button is wedged in between the volume buttons, whereas on the ZenFone 2, the power button can be found on top. The problem with this placement is that it makes the power button quite difficult to reach while using the phone one-handed.

Our review ZenFone 2 uses a 5.5-inch Full HD 1,920 x 1,080 pixels (403ppi) resolution IPS LCD display. Clarity is top notch and color reproduction was accurate, although contrast could probably be a bit better.

On the rear of the phone, you'll find a 13-megapixel, f/2.0 camera module with dual-color LED flash and updated PixelMaster

technology. Image quality is generally good and it takes decent low-light shots. While comparable to other high-end flagship smartphones, you'll notice the lack of optical image stabilization.

The ZenFone 2 runs on Android 5.0 Lollipop and the latest version of ZenUI form ASUS. One of the more notable new features in ZenUI is ZenMotion, which lets you use gestures to quickly launch apps while the display is asleep. For example, draw a C to launch the camera, a W to launch the internet browser, an S to launch SMS messages, or an E to launch e-mail. ZenMotion also lets you flip the phone face down to mute an incoming call or any music playing.

The top-end model, ZE551ML, is powered by a quad-core Intel Atom Z3580 2.3GHz processor. Benchmark performance was quite good, surpassing last year's Qualcomm Snapdragon 801, but falling short of this year's Snapdragon 810. Unfortunately, battery life

fared a little on the low side, lasting just over seven hours in our video looping benchmark.

The price of the ZenFone 2 can range from \$249 for the lowest end model to \$429 for the top-tier variant that's reviewed here. And considering its near flagship-level benchmark performance, Full HD 5.5-inch display, reasonably good camera and comfortable ergonomics, it's still a great proposition. Sure, we're being spoilt by all the metal phones the big boys are releasing, but at this price point? We're not complaining and neither should you.

by James Lu

TESTED & RATED

**8.0**<sub>/10</sub>

**HWM**  
SINGAPORE





# TRANSFORMING AHEAD

## ASUS Transformer Book T300 Chi

### AT A GLANCE

#### Processor

Intel Core M-5Y71  
(1.2GHz, 4MB L3 cache)

#### Memory

8GB LPDDR3 RAM

#### Graphics

Intel HD Graphics 5300

#### Storage

128GB SSD

#### Price

\$1,498



The keyboard adds considerable heft, but is a joy to use for typing.

It has taken a long time, but the ASUS Transformer Book T300 Chi is finally here. We saw this hybrid 2-in-1 notebook first in June at Computex last year and were astounded by its amazingly thin design. To be exact, the tablet display measures just 7.6mm thick and weighs only slightly above 700g, which means it's not much thicker than an iPhone. Its light weight does not mean ASUS has scrimped on specifications. In fact, the display measures 12.5-inch diagonally and outputs a resolution of 2,560 x 1,440 pixels, giving it a pixel density count of just under 235 pixels per inch, which is comparable to the Retina displays found on Apple's MacBook Pro notebooks. The display is crisp and sharp and viewing angles are great. Our only complaint is that the screen

seems a little dark even at maximum brightness settings.

ASUS has placed an increased emphasis on design in recent years and the Transformer Book T300 Chi features an all-aluminum construction that feels strong despite its thinness, and does not exhibit any signs of flexing. The edges are chamfered using a diamond-cutting polish and gleam brightly when it catches light at the right angles.

Because the Transformer Book T300 Chi is so thin, ASUS could not afford to outfit it with standard full-size USB and HDMI ports. Instead, the device has a more compact micro-USB port and micro-HDMI port. Fortunately, ASUS provides a micro-USB to USB adapter, so you can still use your USB devices easily.

The Transformer Book

T300 Chi also comes with a detachable keyboard dock, which attaches to the tablet display via a magnetic hinge. At this point it's worth noting that the keyboard dock does add sizable heft to the Transformer Book T300 Chi. Thickness goes up to 16.5mm, while weight doubles to around 1.43kg. But on the plus side, the keyboard is excellent to type on and the trackpad, though a tad narrow, is responsive and accurate.

The ASUS Transformer Book T300 Chi is so thin mainly because it is powered by one of Intel's new Core M processors. They are designed specifically for use in ultra-thin notebooks and hybrid devices and has a TDP of just 4.5W so requires no active cooling. What powers the Transformer Book T300 Chi is the top-of-the-line





Because the Transformer Book T300 Chi is so thin, ASUS has to outfit it with micro-USB and HDMI ports.

#### CONCLUSION

**This is the best implementation of Intel's new Core M processor we have seen yet.**

Core M-5Y71, a dual-core part that has a base clock of 1.2GHz and a maximum turbo clock speed of 2.9GHz, along with a 4M L3 cache. The Core M-5Y71 also features Intel's new integrated Intel HD Graphics 5300 GPU, which features 24 execution units and runs at a maximum clock speed of 900MHz. Finally, because the processor is so power efficient, the Transformer Book T300 Chi, despite its compact dimensions and tiny 32Whr battery, has a tested battery life of about four hours.

Now, the concept of hybrid devices is not new, but few can properly execute it. To date, amongst the many hybrid devices we have reviewed, the Lenovo Yoga 3 Pro and Microsoft Surface Pro 3 are the ones that best embody this idea, combining the best aspects of a tablet and an

ultraportable notebook. The ASUS Transformer Book T300 Chi can now count itself in this list.

Despite its thinness and lightness, it felt sturdy, strong and did not exhibit any noticeable signs of flexing. And because it is so thin and light, the Transformer Book T300 Chi was able to fulfill its role as a tablet well. It did not feel unwieldy to handle at all, even if its 12.5-inch display is large by tablet standards. Tablet mode aside, the ASUS Transformer Book T300 Chi also worked well as notebook, thanks mostly to the incredibly well-made keyboard dock.

Unfortunately, performance is not one of the Intel Core M's strong suits. In our tests, we found that it would trail an Intel Core i5 system by around 15% to 30%. It's by no means underpowered for

its category and not a fault of ASUS, but anyone looking at one of these super-sleek new Core M machines will have to get used to lower performance than a Core i5.

All things considered, the ASUS Transformer Book T300 Chi is one of the best implementations we have seen yet of Intel's new low-power Core M processors. And at \$1,498, it's decently priced for its design, build quality, features and performance.

by *Kenny Yeo*

TESTED & RATED

**8.5**<sub>/10</sub>

**HWM**  
SINGAPORE



# FORM OVER FUNCTION

## Fitbit Charge HR

### AT A GLANCE

**Connectivity**  
Bluetooth 4.0

**Display**  
OLED

**Claimed battery life**  
5 days

**Price**  
\$199



The Fitbit Charge HR has an integrated optical heart-rate sensor, which is nifty if only it were more accurate.

### CONCLUSION

**The Charge HR is comfortable to wear and does some things well, pity then the heart rate sensor is so unreliable.**

Fitbit is the dominant fitness tracker brand in the U.S. and boasts of a 68% share of the market in terms of dollars. The company announced two new fitness trackers called the Charge and Charge HR late last year. The two are almost identical, but the Charge HR features an additional integrated optical heart-rate sensor and a better designed clasp that makes wearing it easier and more comfortable.

The Charge HR is available in a variety of colors - black, plum, blue and orange - and is made mostly out of texturized rubber. It fits well on the wrist, but can be uncomfortable to wear on warm days. The Charge HR also features a tiny OLED display that can be used to quickly see your day's progress. And if the Charge HR is synced to your phone, the Charge HR will even

vibrate when you receive calls and will display the number on its OLED display. Beyond this, the OLED display does not do anything else since the Charge HR cannot be used to display notifications, such as text messages or Facebook updates, from your phone.

The Charge HR offers functionality that is typical of most fitness trackers, it counts the number of steps you've taken, your workouts, distance traveled, calories burned and sleep. And because it features an integrated optical heart rate sensor, it is able to cross-reference your heart rate to your workouts and sleep, to given a better idea of your general well-being.

Unfortunately, the heart-rate sensor on the Charge HR was rather iffy and constantly under-reported what our actual heart rate should have been. On a

more positive note, the pedometer functionality of the Charge HR worked as well as any other fitness tracker we have tested. Additionally, the Charge HR is one of the few fitness trackers that is intelligent enough to know when the wearer is asleep. As such, there is no need to put the Charge HR into "sleep" mode before going to bed like most other fitness trackers.

The accompanying Fitbit app does a good job of allowing wearers to quickly and easily monitor their progress and performances, so we have no complaints on that front.

All things considered, the Charge HR is a stylish and capable fitness tracker that would have fared better if only its heart rate sensor was more accurate.

by *Kenny Yeo*



TESTED & RATED

**7.5**<sub>/10</sub>

**HWM**  
SINGAPORE



# LET THERE BE (AMBI)LIGHT

**Philips 65PUT8609/98 4K TV**

For those unaware, a few years ago, Philips sold a majority stake of its TV business to TPV Technology. A joint venture, TP Vision, was the result; and since 2012, it has been responsible for selling Philips-branded TV sets around the world.

The 65PUT8609/98 we've here belongs to the Philips 8600 series. An LED-backlit LCD 4K UHD TV, it sports a dual-core processor for ensuring smart TV operation responsiveness, 20W speakers, four HDMI connections, two USB ports, and built-in Wi-Fi. It's also a 3D TV that uses active 3D tech, which means the glasses have to be battery-powered (in this case, a small CR2032 cell). There's no built-in camera on the 8609, so if you wish to do Skype video calls on the TV, you've to buy a separate camera attachment.

A sleek TV with a narrow bezel, the 8609 also supports Ambilight+Hue, which means you can set your Philips Hue lamps to follow the TV's Ambilight colors. For

the uninitiated, Ambilight is a lighting system created by Philips where by LEDs around the TV cabinet actively glow in different colors according to the video content. The idea is to create a more immersive viewing experience. Its effectiveness really depends on the individual, but it certainly looks cool when used as a lounge light effect during TV standby.

Of course, the 8609 is also a smart TV, which means you can install apps and surf the internet on it. You can also check your Twitter feed on the TV. And with Cloud Explorer, it's easy to access online storage services like Dropbox. The bundled remote control is fairly easy to use, and what we really like about it is the keypad on the reverse side, which makes entering text so much faster.

Picture quality-wise, the 8609 exhibits good detail level and vivid colors. Philips touts a 400Hz Perfect Motion Rate Ultra number, which suggests a 100Hz native panel refresh rate.

Regardless, moving images looked smooth in our tests, and resolution was kept reasonably high. If you're shopping for a TV for use in a bright living room, know that the 8609 doesn't go very bright (Philips lists brightness at 350cd/m<sup>2</sup>) compared to some of its peers in the same price range.

Also, while images look pin sharp at 4K resolution, the HDMI inputs support only up to 30Hz at 4K. Black level response was found to be above average with the Standard picture style, but improved noticeably when we switched to the Movie preset.

All in all, the Philips 65PUT8609/98 is a very decent 4K TV, capable of pleasing colors and super-sharp images. Versus other 4K TV in its class, it didn't fare badly but neither did it stand out. Its \$7,999 price tag is our main complaint, as there are already other 4K TVs with better performance that cost less today.

by Ng Chong Seng

## AT A GLANCE

**Screen Size**  
65 inches

**Resolution**  
3,840 x 2,160 pixels

**Backlight**  
LED

**3D Type**  
Active 3D

**Price**  
\$7,999



The keypad on the remote makes entering URLs a breeze.

## CONCLUSION

**A cool-looking 4K TV for any living room; if only the price can come down a bit.**

TESTED & RATED

**7.0**<sub>/10</sub>

**HWM**  
SINGAPORE





## AT A GLANCE

**Dimensions**

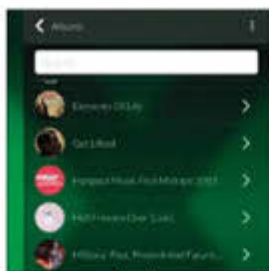
402 x 137 x 194mm

**Weight**

3.8kg

**Price**

\$549



The drawer style interface of the app is a pretty efficient way of sorting through your songs.



The volume dial is a touch sensitive pad.

# A SLICE OF MULTI-ROOM FUN

## Samsung WAM750

The multi-room streaming audio segment is slowly but surely starting to heat up, with entrants from all companies starting to enter the fray. The latest of such speakers to come into our lab is the Samsung WAM750 Wireless Multi-room speaker, and this leads the current set of the Samsung WAM550 and WAM350 wireless speakers again of varying sizes. There's also a Wireless Audio Multi-room Connect Hub WAM250 that's said to "help bring all your music together".

In reality, the Hub WAM250 is practically essential if you'd like to experience multi-room audio, which is basically the whole point of this series. Set-up can be tricky over Wi-fi as the WAM750 didn't seem to initially be able to pick up our device.

Initiate a connection via Bluetooth first though, and the subsequent pairing goes a lot smoother.

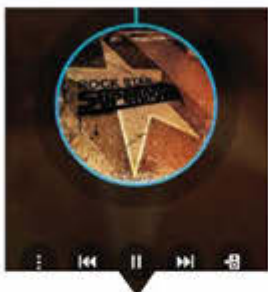
For whichever reason, that method worked best for us, and once paired, playing songs from our mobile device was a simple affair. The app boasts a nicely designed interface, using a drawer-style method to sort tracks in your music library by title, artist name, and album.

There's a virtual scroll wheel that dominates the player interface, and that lets you scroll between tracks, albums, or songs depending on which category you last selected. It's an interesting implementation, but we're not sure if it wouldn't have been better served by acting as a means of letting you scrub through a track instead. That's one thing

that's severely lacking as it doesn't seem like there's any way to go forward or back in a particular song.

Another thing that you have to take note of is that tapping a track automatically starts it playing and pushes it to the start of a default playlist when you tap on it. If you had selected an album to play for example, then clicked on another song, the new song will play and then the app will move on to the rest of the songs in the first album, which isn't the most intuitive control method. Clicking the small boxes by the side of any track though, will give you more options.

That's the bit of extra confusion that mars an otherwise well designed app. Other than providing support for popular streaming sites like TuneIn



We do wish there was more control on this control dial though.

#### CONCLUSION

**Good audio performance, but the multi-room system needs to stand alone better.**

TESTED & RATED

**8.5**<sub>/10</sub>

**HWM**  
SINGAPORE

Radio, Amazon, Napster and Deezer, the WAM750 also supports most of the popular audio formats like AAC, MP3, WAV, OGG, WMA, FLAC, AIFF and ALAC up to 24bit/192kHz, thus keeping in line with the current trend towards High Resolution Audio.

The WAM750 integrates five speaker drivers, with one 4-inch Woofer, two 19mm Tweeters, and two 56mm mid-range drivers, which should make for a fairly solid performance throughout the audio range. But, for certain tracks, the bass didn't extend down quite as much as we liked. On Rebecca Pidgeon's

Spanish Harlem for example, the bass didn't quite have enough depth to draw you into the track. There was good body in Pidgeon's vocals, and the speaker seemed to give her just about enough presence to stand out in what seemed to be a medium-sized sound stage. So, that touch more bass would have grounded the track and improved the overall listening experience.

Moving on to our regular test tracks showed that the speaker was very much focused on the mids and lower-mids. With Tiesto's Elements of Life for example, the intro riff was quite nicely resolved,

and the speakers seemed to keep up with the attack of this pacy track fair well. There was good body to the bass, but when it moved into the lower registers, it seemed like the bass was a little boomy, detracting from the performance somewhat.

Hotel California by The Eagles though, allowed the WAM750 to shine as there was just about enough weight on the bongo drums to pace the track, while providing a nice ring from the main guitars. There was good separation between Don Henley and Joe Walsh's vocals (and indeed the rest of the members of the band), and the solo was fairly well handled. If anything, we wish the speaker had picked up just a bit more of the audio from the crowd, so as to give a better sense of the live atmosphere of that recording.

Overall, we do think the WAM750 is a pretty good speaker for the price, though we must say that we're not fans of needing to use a separate Connect Hub WAM250 to achieve multi-room audio if you're using more than one speaker.

by *Marcus Wong*



## AT A GLANCE

**Sensor**

APS-C CMOS

**Megapixels**

16.3-megapixels

**Dimensions**

116.9 x 66.5 x 40.4mm

**Weight**

300g (body only)

**Price**\$899.00  
(with XC 16-50mm  
f/3.5-5.6 OIS II lens)

The X-A2 comes with a pop-up flash.

# X HITS THE SPOT

## Fujifilm X-A2

An update to 2013's X-A1, the X-A2 is virtually identical to the original, with the exception of the rear LCD screen. Like most of this year's releases, it now tilts up a full 180-degrees to facilitate easier selfies, though you'll need to slide the LCD up to fully see yourself. There's no viewfinder of any sort, but it does feature in-built Wi-Fi so you can send images directly to a connected smart device.

When flipped up fully, the camera automatically goes into selfie mode, using face and eye detection to help ensure everything is kept in focus. Now, this is an important, as the LCD panel isn't touch enabled,

meaning that in selfie mode, you'll have to blindly fumble with the rear directional pad to shift focus points otherwise. Perhaps taking a leaf from the competition, the X-A2 also offers a new Portrait Enhancer mode to help you apply some basic smoothing and brightening to your selfies.

Coming back to the Eye Detect autofocus, we thought that while it seemed to work decently well in terms of locating and tracking eyes, it seemed a little slow to readjust when our subject turned away or adjusted their pose. So, we'd probably use it for more controlled shooting situations where there's greater interaction between

you and your subject.

We like that the X-A2 maintains two dials for better manual control of settings, but do wish that Fujifilm had a change of heart and placed one of their X-Trans sensors inside, as that really is the distinguishing feature of the X-series. Perhaps of some consolation though, is the fact that Fujifilm has added their "Classic Chrome" film simulation mode to the X-A2, so you can get somewhat closer to the colors that are the hallmarks of the X-series.

Paired with the new XC16-50mm II f/3.5-5.6 OIS kit lens, the X-A2 feels comfortable in the hands, and the new lens gives







The LCD now flips up for easy selfies.

#### CONCLUSION

**A no-fuss system camera that turns in very acceptable results.**

better play when focusing manually, which certainly is a boon. In fact, because the lens focuses by wire, you can even switch the direction of focus in the menu settings; handy if you're coming from other systems.

Shooting with the X-A2 is a fuss-free affair. Focusing is fairly fast, but not always accurate if you're using the Multi autofocus mode. Instead, we much prefer using the area mode as that lets you manually select the focus point using the selector. It's not as easy as using touch, but we do like the fact that the sub-control dial allows you to adjust the size of the AF focus frame for greater accuracy.

While it doesn't sport an X-Trans sensor, the X-A2's

APS-C CMOS sensor does seem to resolve a good amount of detail and color, which makes for vibrant images with good detail. What we do find though, is that the images tend to have a bit of a cyan cast over them, which will require some correction in post.

By our estimates, the camera tends to go about half a stop under outdoors, but for our indoor tests, it seems to give accurate exposure, so perhaps there is something in the exposure algorithms that gives particular weightage to preserving highlights, resulting in the images being seemingly slightly underexposed.

Overall, we'd say that the X-A2 is a fairly competent

camera that should more than match the needs of first-time users who are moving into the world of interchangeable lens cameras. For under a thousand dollars, you get a larger APS-C sensor that offers a good balance between control and user-friendliness in terms of scene modes and filters.

by *Marcus Wong*

TESTED & RATED

**8.0**<sub>/10</sub>

**HWM**  
SINGAPORE



# ANOTHER GORGEOUS DEVICE, BUT IS IT WORTH THE UPGRADE?

## HTC One M9

### AT A GLANCE

#### OS

Android 5.0 Lollipop

#### Display

5-inch 1,920 x 1,080 pixels (441ppi)  
Super LCD3

#### Processor

Qualcomm Snapdragon 810 octa-core  
(Quad-core 1.5 GHz Cortex-A53 & Quad-core 2 GHz Cortex-A57)

#### Storage

32GB internal storage  
(microSD support up to 128GB)

#### Price

\$1,008

HTC's latest flagship smartphone, the HTC One M9, seems to be following the rule, "If it ain't broken, don't fix it." The One M9 shares an almost identical design as its predecessor (and even its predecessor's predecessor), with just a few minor tweaks to differentiate it from last year's model.

Most noticeably, the new M9 has a two-tone design. Where the back of the One M8 curved all the way around to the screen, the M9 stops about halfway between the back and the front in a pronounced ridge. The design is most evident on the new gold-silver finish, which is gold on the

edge and brushed silver on the back, but even the more muted gun-metal gray version is subtly different on the front and back.

HTC has also finally relocated the power button from the top edge to the right-hand side, below the volume buttons. It's more ergonomically friendly now, easier to reach, and more in-line with what everyone else is doing. All the buttons on the M9 are now metal, and the power button even has a light circular etching on it so you can easily see and feel the difference between it and the volume buttons.

The rest of the HTC One M9 is almost exactly the

same as the One M8, with a gently curved all-metal body, and inset plastic antenna lines. It's 0.26mm thicker than its predecessor, and about 1mm shorter and narrower, as well as 3g lighter, but all of these things are pretty much unnoticeable.

The M9 has a 5-inch display with a Full HD resolution (441 ppi), which is the exact same size and pixel count as its predecessor. Unsurprisingly, there's no visible difference in clarity between the two displays. Text looks sharp and crisp and the Super LCD3 display provides decent contrast and color reproduction too.



HTC's UltraPixel technology has moved to the front 4-megapixel camera, while the rear is now a regular 20.7-megapixel shooter.



The M9 has revamped BoomSound dual front-facing stereo speakers resulting in the best smartphone audio around.

#### CONCLUSION

**The HTC One M9 looks gorgeous, but it leaves a very big question hanging over HTC's head. Where does it go from here?**

Audio has always been HTC's trump card, and once again the One M9's front-facing BoomSound stereo speakers deliver. This year's BoomSound speakers get a Dolby surround treatment (although One M8 users can also get this by upgrading to HTC Sense 7.0) and the result is rich, deep and loud audio. The small speakers have surprisingly good depth, and lots of mid-range detail, although as you might expect, the low-end is a little lacking.

Camera-wise, HTC has ditched its gimmicky UltraPixel and Duo Camera technology, opting instead for a regular 20.7-megapixel f/2.2 rear camera (UltraPixel isn't actually entirely gone, you'll find it on the front 4-megapixel camera). Image quality on the M9 was fairly good, and sharp throughout the image, although noise control was a bit too

aggressive for our liking.

The One M9 runs on Android 5.0 Lollipop with HTC's Sense 7.0 UI on top of it. If you're familiar with Sense UI from previous versions of the HTC One, you'll feel right at home with the HTC One M9 as there's not much different here. One new feature is Sense Home, which displays eight apps (or app folders) on your homescreen depending on your location. For example, if you're at home, it might display Clash of Clans, Spotify and YouTube. Whereas, when you're at work, it will show your Calendar and Email. A third location is simply called "Out" and will display travel apps such as Google Maps.

The M9 is powered by a Qualcomm Snapdragon 810 64-bit octa-core processor with 3GB RAM. Performance-wise, it scored well on our benchmark tests, but wasn't

quite as good as Samsung's Galaxy S6. Battery life was a little disappointing though, lasting just short of eight hours.

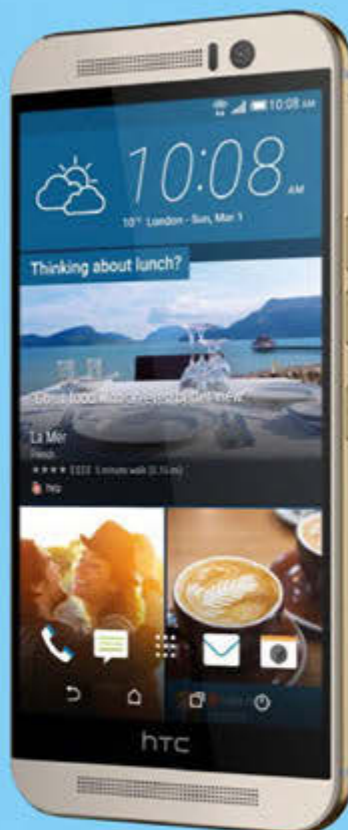
Two years ago, HTC was breaking new ground and leading the way for Android phones with the all metal HTC One M7, but now its competitors have caught up. There's not much new or exciting about the One M9 and while it's still a great phone on its own merits, we expected more from HTC.

by James Lu

TESTED & RATED

**8.0**<sub>/10</sub>

**HWM**  
SINGAPORE





# (PRE)BUILT FOR GAMERS

## ASUS ROG G20AJ

### AT A GLANCE

#### Processor

Intel i7-4790 @ 3.6GHz  
(Turbo Boost up to  
4GHz) with 8MB  
L3 cache

#### Graphics

NVIDIA GeForce  
GTX 970

#### Memory

2 x 8GB DDR3

#### Price

\$2,699



The ROG G20 features a distinctive Mayan-inspired mesh design at the top and front that lends to its futuristic appeal.

### CONCLUSION

**The ASUS ROG G20AJ is a sleek, high-performance and convenient alternative to a DIY PC.**

The ASUS ROG G20AJ is a high-performance gaming PC fitted into a compact 12.5L case. The sleek chassis is one of the standout features of the ROG G20, with its signature ROG red-and-black color scheme, matte black side panels and a striking narrow, red I/O front panel.

It also ditches the traditional boxy outlines of most PC cases in favor of more unique geometries and bold angles. The front and top of the case feature a Mayan-inspired mesh design, which combine with the front red LED lighting for an aggressive, futuristic look.

Moving around to the back of the chassis, we see that

the graphics card has been rotated 90 degrees to sit flat against the motherboard. This is partly how ASUS has managed to maintain such a slim profile with a full-sized NVIDIA GeForce GTX 970.

The chassis lacks any dedicated rear exhaust vents for the CPU, and ASUS has instead chosen to install vents below the mesh design at the top to take advantage of natural thermal convection. Upon opening up the chassis, we found that the internal blowers are also aligned to exhaust upwards, further helping with cooling.

ASUS has placed quite a lot of emphasis on the ROG G20's thermal design, which it says

has been specially engineered for silent operation. In our tests, we found this to be quite true – save for an audible whirr when powering up, the ROG G20 was quite silent throughout.

Powered by a quad-core Intel i7-4790 processor and NVIDIA GeForce GTX 970, the ASUS ROG G20 has the hardware to match its modern design. In our gaming benchmarks, the ROG G20 handled the demanding Middle-earth: Shadow of Mordor well, posting a more-than respectable 73.45fps with all the settings cranked up. In Grand Theft Auto V, it managed a very playable 42fps with all the graphics set to Very High. With these performance numbers, the ROG G20 should have no problem handling most modern games.

The ROG G20 may be pricey, but its price is quite justifiable. It's targeted at a niche audience that expects pre-assembled, sleek systems that perform well, which is exactly what the ROG G20 delivers. It boasts an excellent design, quiet and powerful processing, customized lighting control, plus warranty and support, making it a great option for those who choose to avoid the DIY route.

by Koh Wanzhi



TESTED & RATED

**8.0**<sub>/10</sub>

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Empty Phantasm Shell

## AT A GLANCE

**Developer**  
From Software

**Publisher**  
Sony Computer  
Entertainment

**Platform**  
PS4

**Genre**  
Action RPG



All right hand weapons in Bloodborne have two forms. The best is arguably Ludwig's Holy Blade or the Saw Axe.

## CONCLUSION

**Loading times notwithstanding, its challenging gameplay, combat and visual aesthetics make it the best title out on the PS4 now.**

TESTED &amp; RATED

9.0/10

HWM  
SINGAPOREFROM HELL,  
WITH LOVE

## Bloodborne

From Software's really outdone themselves, creating a title that has enough of the Souls games to feel familiar, but different enough to feel fresh and new.

While the Souls games mainly drew their art inspiration from medieval and fantasy settings, the art direction in Bloodborne is definitely inspired by Gothic architecture. In fact, the settings and enemies of the game wouldn't be out of place if they were in a Castlevania game. From the parapets of a huge abandoned castle to expansive hallways lit only by torchlight, the visual design in Bloodborne is one of the best on the PS4 so far.

Bloodborne also shares many gameplay similarities with Demon's Souls and the Dark Souls games. The difficulty is through the roof,

so be forewarned that this game is definitely not for beginners or if you happen to have anger management issues. No matter how good of a gamer you are, you'll die an ungodly amount of times. For me though, I'm a glutton for punishment. What I don't like however, are the ridiculously long loading times that accompany each death (as the game resets itself). They're more bearable if you've gotten an SSD upgrade, if only slightly.

Now, despite dying being a regular occurrence, combat is much more open and introduces a risk/reward element to the gameplay. If you get hit, you can potentially recover your lost health by quickly going back on the offensive and landing successful hits on the enemy. Of course, if you're reckless about it,

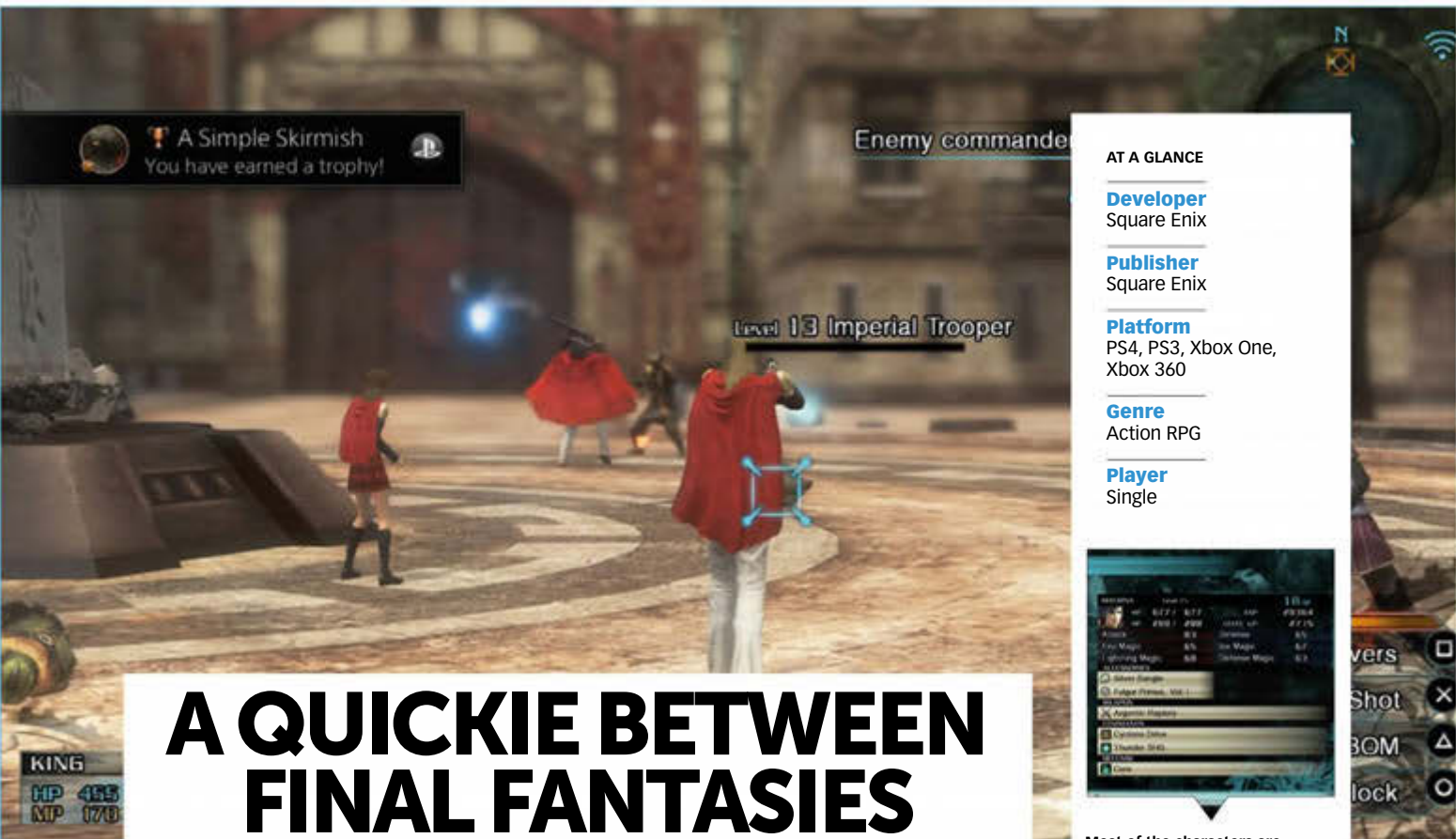
you'll just end up dead... again.

With everything it has going for it, frame rates run decent most of the time, but you will notice some stutter whenever there's a lot of action on screen.

Where you'll get your money's worth is the boatload of content the game offers. It has a relatively non-linear gameplay, with shortcuts that gradually open up and connect the various areas of the game together. And let me tell you, there are a wealth of optional areas, hidden items and secret bosses to uncover with really high replay value. If you really wanted to find everything, including the ultra-secret ending, expect somewhat north of 12-hours each playthrough.

by Salehuddin Husin





# A QUICKIE BETWEEN FINAL FANTASIES

Final Fantasy Type-0 HD

As a game that was originally released on the PSP, Final Fantasy Type-0 HD (FFT0) eschews many of the conventions of the series, mainly nixing the Active Time Battles that made the series so recognizable in the past. It's now an Action RPG, with real-time battles. There's even a pseudo-time management element thrown in for kicks. Finally, instead of a small group of characters, you control a whole class of misfits (fourteen in all), each with different weapons and skills.

Remade in HD, this is the first time the game has been translated into English. The translation's up to Square Enix's localization standards but the rest of the game is a mixed bag. The gameplay simply doesn't translate well to a console experience, where gamers are normally expecting a much lengthier experience. That's not to say the game's short, but if you

were expecting something of FFXVII or FFX calibre, you'll be sorely disappointed.

As an RPG, the plot in FFT0 is laughable. It's ridiculously convoluted and dense at best, though some instances it borders on being equal parts boring and insipid. While the presentation in the game is pretty good, there are some overwhelming oversights. For one, battles don't have summary screens at the end, which means you don't know how much exp you got from beating that group of enemies, or how much more before you level up.

Since there's a boatload of playable characters this time, juggling them all to be relatively same level is a headache. Square Enix made it even more of a pain when only the characters in your party gain experience, which means you have to constantly rotate who you field to keep everybody in fighting form.

It's a good thing then that there's a Secret Training option, which allows you to level up a character when you're not playing the game.

The portable roots of FFT0 clearly show enough that nobody will mistake the game for a new title. Textures, though of higher resolution, are still blurry and muddy. They get even worse when you go up close to them. Character models are also the same, with low poly models on both enemies and playable characters. Luckily, an awesome score and decent voice acting helps balance things out somewhat.

Now that FFT0 is here, the rest of the world can finally see what it has been missing all these years. Truthfully though, I'd have been fine if it wasn't translated at all. I guess we all need something to do till Final Fantasy XV.

by Salehuddin Husin

## AT A GLANCE

**Developer**  
Square Enix

**Publisher**  
Square Enix

**Platform**  
PS4, PS3, Xbox One, Xbox 360

**Genre**  
Action RPG

**Player**  
Single



Most of the characters are named after cards except from Rem and Machina.

## CONCLUSION

**It might have been a decent mobile game, but FFT0 is proof that you can't just slap on sharper graphics for a console port and call it a day.**

TESTED & RATED

**6.0**<sub>/10</sub>

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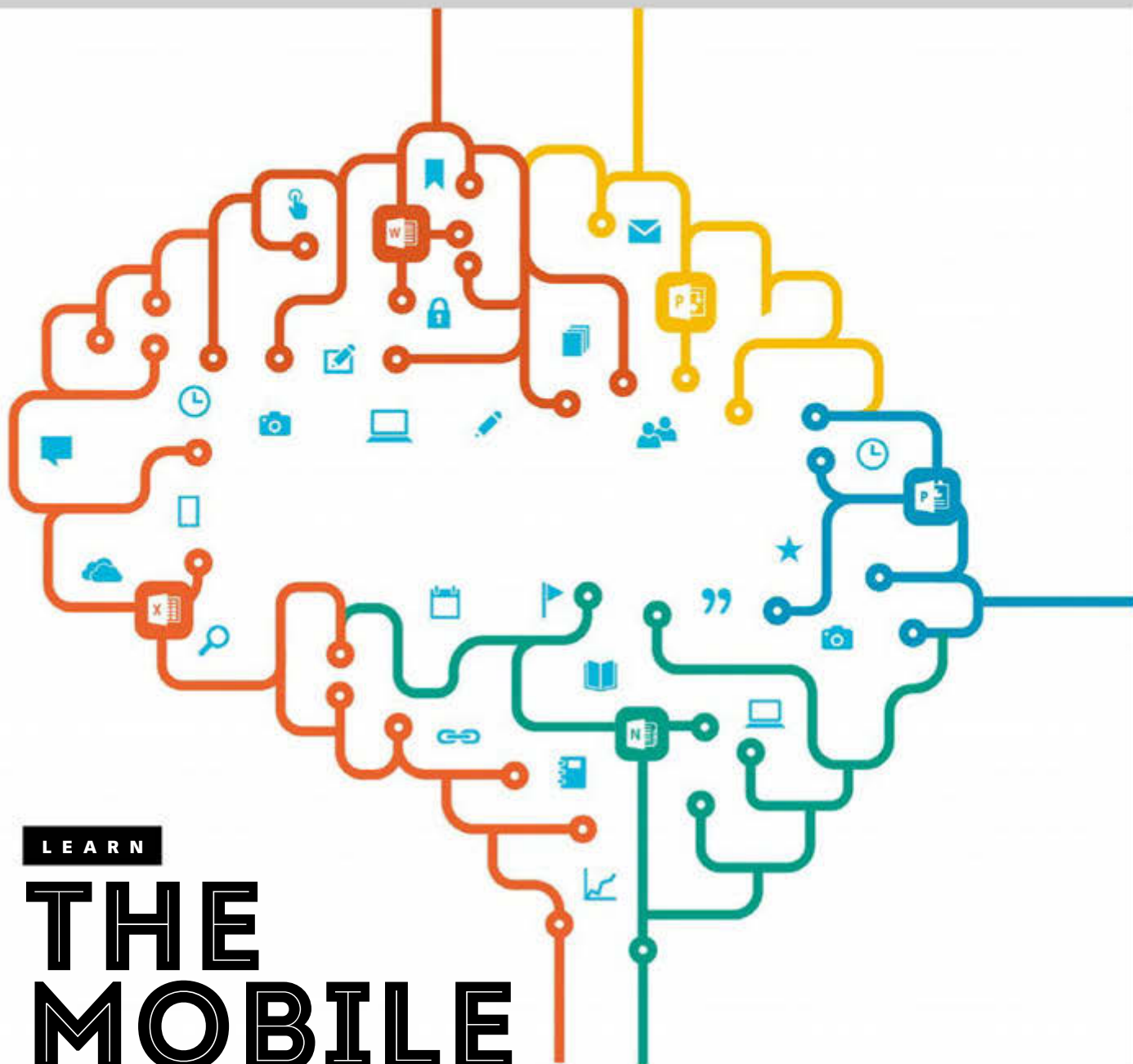
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LEARN

# THE MOBILE TAKEOVER

There's no escaping that our lives are going to be more mobile than ever. In this issue's Learn, you'll get a glimpse of what to expect from Microsoft's next generation operating system, how to take advantage of your advanced smartphone camera, the intricacies of high-resolution audio and how to use that fancy stopwatch on your analog wristwatch like your grandfather used to do.

Text by *Team HWM*  
Art Direction by *Ken Koh*

## MORE INSIDE >

- TYPES OF CHRONOGRAPHS AND HOW TO USE THEM
- HARDWARE CONSIDERATIONS FOR A HIGH-RES AUDIO EXPERIENCE



# MICROSOFT BUILD 2015: 6 THINGS YOU NEED TO KNOW

While Microsoft's annual Build conference is a developer-centric event, many of its announcements have a direct impact on consumers. The latest Build took place just last month. Here are some of the latest Windows 10 developments worth knowing about.

by Ng Chong Seng

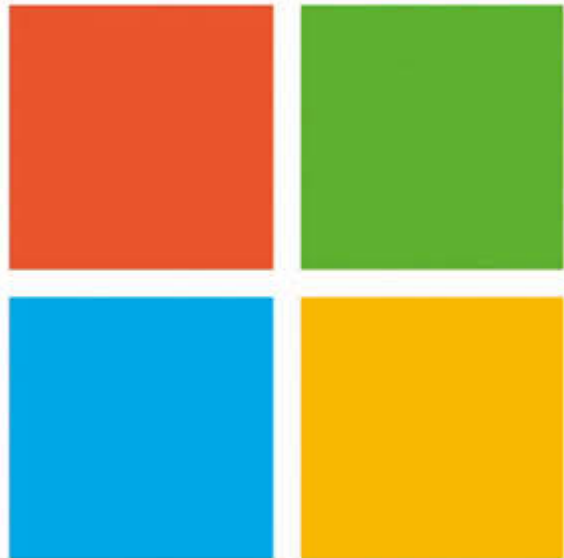
## REWORKED ANDROID AND IOS APPS ON WINDOWS 10

Microsoft has announced four toolkits so that developers can easily bring their apps to the Windows Store, regardless of where their code base originates from. The two that would impact mobile users the most are codenamed Project Astoria and Project Islandwood. The former lets Android developers reuse almost all existing Java and C++ code to create apps for Windows 10 phones; the latter lets iOS developers convert their apps to universal Windows apps easily in Visual Studio.

Not interested in mobile? Another toolkit no less important is Project Centennial, used for bringing classic .NET and Win32 apps to the Windows Store. One major developer that's already onboard is Adobe, who's porting Photoshop Elements. Expect more apps on the Windows Store in the near future.



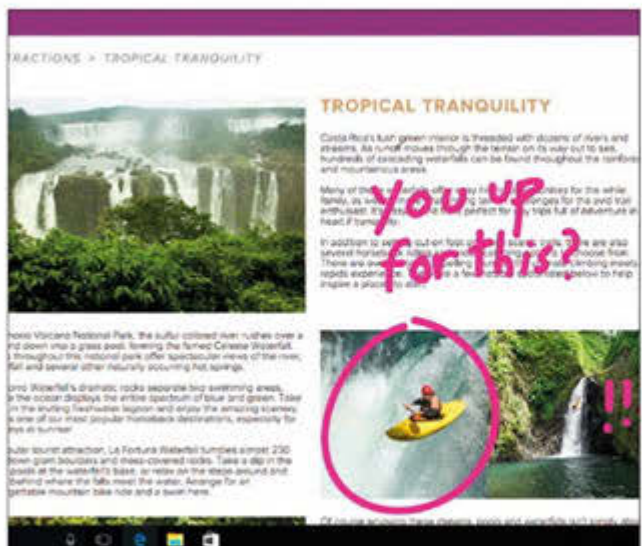
With these toolkits, we can look forward to an app boom on the Windows Store.



## WINDOWS 10'S NEW BROWSER IS CALLED MICROSOFT EDGE

Previously known as Project Spartan, the new default browser in Windows 10 has a confirmed name: Microsoft Edge. A universal Windows app, it will only support the new EdgeHTML rendering engine, which is optimized for modern websites and standards. There's also a note-taking mode whereby you can doodle or annotate on a webpage directly, a Reading Mode for distraction-free reading, a Reading List that supports offline reading and which syncs across devices, and Cortana integration.

According to Microsoft, in both Octane 2.0 and JetStream benchmarks, Edge also outpaces other modern browsers like Chrome Canary and Firefox Alpha. And inline with Microsoft's Universal Windows Platform strategy, developers can turn websites into apps that leverage on unique Windows 10 features like Xbox Live achievements.



Microsoft Edge looks to be a fast and modern browser. Would you use it?

## CONTINUUM GIVES WINDOWS 10 PHONES DESKTOP POWERS

Continuum is a Windows 10 feature that allows you to move from one device to another with ease, as it handles UI transitions and adapts accordingly to the device. For example, if you are in tablet mode, the UI is optimized for touch; if you dock it to a keyboard and mouse, you get UI elements that are more suitable for a keyboard and mouse combo.

Continuum is coming to phones too. When hooked up to a bigger display, the UI will become more desktop-like, and universal apps like Excel and PowerPoint can be controlled via keyboard and mouse, complete with shortcuts like copy and paste. Continuum for phones requires new hardware that can drive dual screens, which would be announced later.



Continuum for phones wouldn't be possible if Microsoft didn't pursue its Universal Windows Platform strategy.

## VISUAL STUDIO CODE CROSS-PLATFORM CODE EDITOR

Want another piece of evidence that Microsoft is now platform agnostic? Visual Studio Code is a code-optimized editor for building and debugging web and cloud apps, and it runs on Windows, Linux and OS X. Out of the box, it supports multiple languages with enhanced support for Node.js and ASP.NET 5; as well as Git and Visual Studio's features like IntelliSense intelligent code completion and peek.

With Microsoft Azure as the backend, and tools like Visual Studio Code, the Windows-only Visual Studio 2015, and Visual Studio Online, Microsoft aims to offer best-in-class tools for every developer, whether they're developing native or web apps or SaaS (software as a service) offerings. Code is free and available for download now.

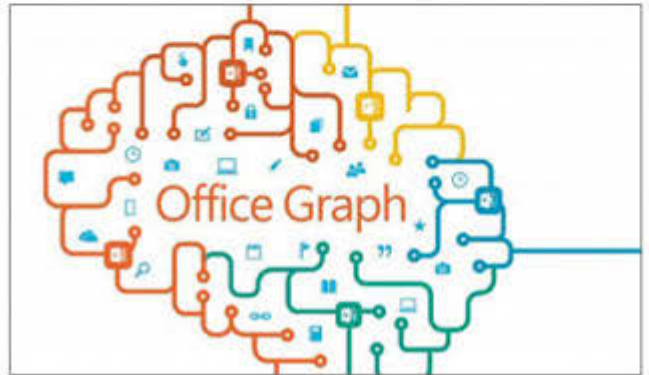


Visual Studio Code is the first cross-platform development tool in the Visual Studio family.

## OFFICE ADD-INS ARE GOING CROSS-PLATFORM TOO

At Build, Microsoft revealed more plans to help developers reach the 1.2 billion Office users out there. First up, there's a new Office Graph API to enable developers to tap into Office data and machine learning capabilities so they can layer third party data to create new intelligent solutions.

Then there are unified consumer and commercial APIs across OneNote, Outlook, and OneDrive. In short, add-ins (or plug-ins) that work across Windows, Office apps for Android and iOS, and of course, the web. The idea of this cross-platform app integration is to enable users to complete a task without having to jump from one app to another. In addition, there's going to be a new, single API endpoint for all Office 365 data queries.



In essence, Office Graph is a big dataset with a framework that helps to make said data available to other apps.

## STAGGERED LAUNCH FOR WINDOWS 10

So far, Microsoft has only said that Windows 10 would be available "this summer" in 190 countries and 111 languages. If we were to take Microsoft literally, this would mean anytime between June 21 and September 23. AMD's CEO Lisa Su recently revealed that the OS would launch in end July, but we've our doubts; because looking the preview builds, there are still several rough edges.

No exact launch date was announced at Build, but Microsoft VP Joe Belfiore did confirm that Windows 10 will arrive at different timings for different devices. Windows 10 for PCs will come first, most probably followed by Windows 10 for phones. HoloLens, IoT, Xbox One, and other devices will get their own version after that, according to their own schedules.



Windows 10 for PCs will be the first version to be released. Windows 10 for phones and other devices will come after that.



# 6 WAYS TO SHOOT FURTHER WITH THE LG G4

The LG G4 is more than just an advanced smartphone, it's also an advanced camera.

by Alvin Soon

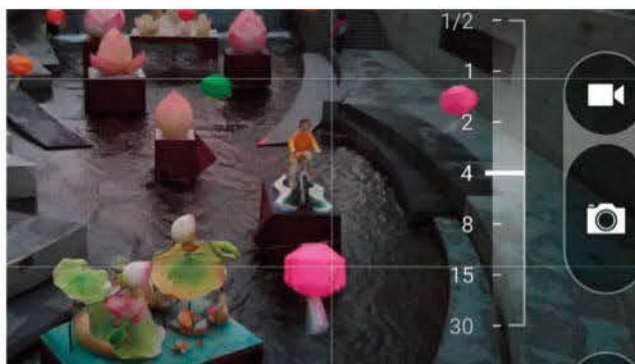
■ LG's newest flagship smartphone is built around a state-of-the-art camera made for both the everyday user and the experienced photographer. The glass is fast, with a wide f/1.8 maximum aperture that captures more light.

The fast lens is paired with a high-resolution 16MP 1/2.6" sensor, and a second generation optical image stabiliser, which can correct for shake in three directions instead of just two. The improved laser auto-focus system makes sure you get the shot in focus, and the new Colour Spectrum Sensor gives you accurate, true-to-life colour with improved white balance.

The G4 camera lets you shoot in Simple, Auto and Manual mode. Simple lets you point and shoot, while Auto gives you more options to play with. But it's Manual mode that gives you much more flexibility when shooting, just as if you're using an advanced digital camera. Here are six ways you can use Manual mode to shoot further.

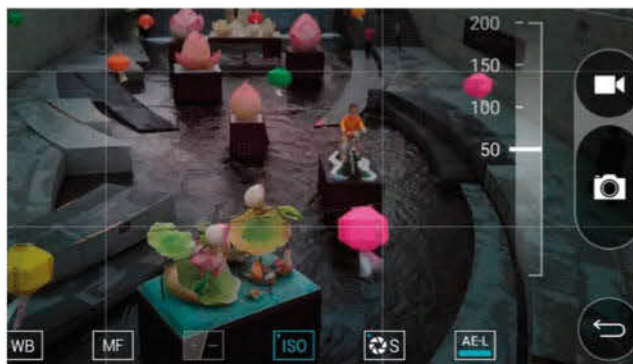
Shot with the LG G4





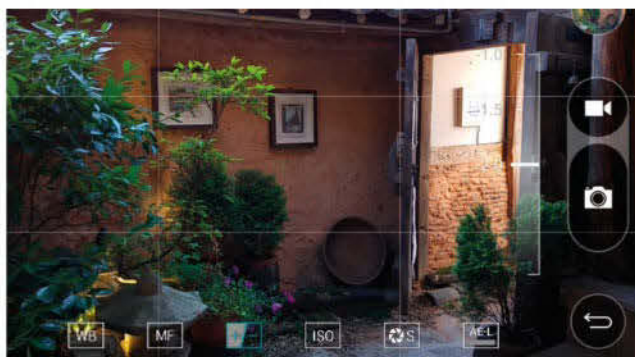
## SHOOT NIGHT SCENES WITH SHUTTER SPEED CONTROL

Whereas most other smartphones require a separate (and compatible) app to do this, the G4 lets you control shutter speed out of the box — up to 30 seconds per exposure. That means you can capture scenes like silky smooth water, city scenes with light trails, and fireworks in the night sky.



## HIGH DEFINITION, LOW NOISE

You can also manually set ISO in Manual mode, which you can use in two ways: When shooting handheld in low-light, you can increase the ISO to make the sensor more sensitive to light and capture more of it. Or, because you can lengthen the shutter speed manually, you can then define a low ISO setting to capture the scene with maximum definition and minimum noise.



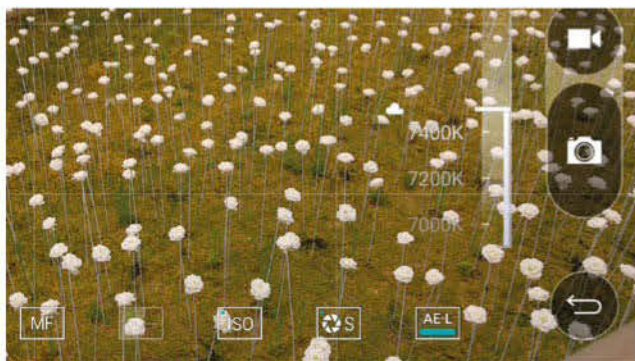
## CONTROL THE LIGHT IN ONE EASY STEP

How many times have you found yourself frustrated with a camera that insists on capturing a scene either too brightly or darkly? The exposure compensation control on the G4 works like the ones on advanced digital cameras, and it lets you easily make a scene brighter or darker simply by sliding the meter.



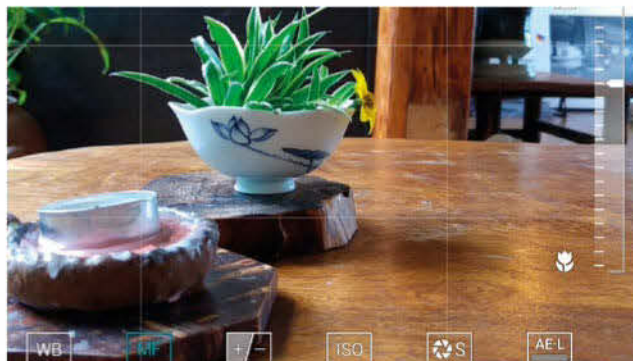
## CAPTURE IN RAW FOR MAXIMUM FLEXIBILITY

One of the limitations with JPEGs is that there's only so much you can pull and push during post-production. In a revolutionary move that caters straight to photographers, the G4 lets you save raw files, giving you more stops to work with afterwards. The file is saved in the universal DNG format, which means it works with most all raw converters right out of the box.



## GO FOR MOOD WITH WHITE BALANCE

The G4 lets you manually set white balance, so you can get accurate white balance just the way you see it. You can also adjust white balance for effect, adding a warmer or cooler cast to the scene, making it look and feel just the way you want it.



## PRECISION FOCUS AT YOUR FINGERTIPS

Get precision focus where you need it with manual focusing on the LG G4. Adjust the slider to focus either up close or further away. With manual focusing, creative experimentation is fully in your control.

# WATCHES IN-DEPTH:

How to use a chronograph.

by *Kenny Yeo*

A chronograph refers to any watch with an integrated stopwatch. And with its sub-dials and pushers, the chronograph is quite possibly the most recognizable complication. It is probably also the most interactive too, since wearers need to activate the pushers to start, stop and reset the chronograph. As a complication, it is one of the most visually interesting too as one can actually see the seconds hand at work, zipping across the dial. This month we explore chronograph complications, its history, importance and how to use it.



## HISTORY OF THE CHRONOGRAPH

The earliest chronograph can be traced back to 1816, and its invention is widely credited to Louis Moinet, a French horologist. Amongst all the complications, the chronograph is widely regarded as one of the most challenging to design and manufacture, even if it looks deceptively simple. In fact, it was only 153 years later in 1969 that the first automatic chronograph was invented - automatic watches have been in existence since 1773.

Moreover, despite the large amount of chronograph watches in the market today, only a very small handful of brands can raise their hands and say that they have a completely in-house design and developed integrated chronograph. Most brands rely on either a third-party movement supplier or a chronograph module supplier.

Most chronographs have three sub-dials, one to count the elapsed hours and another to count the elapsed minutes, the third one is usually the running seconds for timekeeping. The central seconds hand is usually used to track the elapsed seconds. The top pusher is usually used to start and stop the

chronograph, whereas the bottom pusher usually performs the role of resetting the chronograph.

There are three main types of chronographs, and they are the monopusher, flyback chronograph and double chronograph.

Most chronographs have two pushers - one to start and stop timing, and another to reset. The monopusher chronograph reduces this to only a single pusher, and this function is often integrated into the crown itself, which makes for a very clean design. However, it also adds to the complexity of the movement.

A flyback chronograph is just like a regular chronograph, except that it does not need to stop and reset itself before it can start timing a new event. When the pusher is activated, the flyback chronograph will instantly reset itself and start timing a new event instantaneously.

A double chronograph is also known as a split-second chronograph. It has two seconds hands, one of which can be stopped at any instant while the other continues to run. This allows it to time two events of different durations.





## TACHYMETER

### Watch - Omega Speedmaster Dark Side of the Moon

To make the most out of the chronograph functions, most chronograph watches have special bezels with markings that can be used to tell additional information, and the most common type of bezel found on chronographs is the tachymeter.

The tachymeter is a scale that can be used to calculate the speed based on travel time. The tachymeter works using this formula  $T = 3600/t$  as its basis, where T is the tachymeter scale value and t is the time taken. Even though it is mostly commonly used to measure speed and distance, what this really means it can actually be used to measure the average rate of any repeating event.

Here is an example. If you were traveling on a car and you knew the distance between each lamp post was 2km, and timing the time it took for the car to get from one lamp post to the next was 30 seconds. At 30 seconds, the tachymeter gives a reading of roughly 120. This means the car would cover 120 units every hour, which means it was traveling at 240km/h.

On the other hand, if the distance between each lamp post was 3.5km and it took the car 50 seconds to get from one lamp post to the next, then the tachymeter scale tells us that it would cover 72 units per unit, which means an average speed of 252km/h.

The tachymeter can also be used to calculate distance, but this is only if the speed is constant. Simply start the chronograph and wait until the seconds hand passes the known speed. So if a train was traveling at exactly 200km/h, when the seconds hand passes 18 seconds, a kilometer would have been covered.



## PULSOMETER

### Watch - Vacheron Constantin Harmony Chronograph

Chronographs with a pulsometer scale are also called doctor's chronograph, because the pulsometer was designed to allow wearers to quickly determine the heart rate of a patient. The scale is usually calibrated for either 15 or 30 heart beats and this would be clearly indicated on the dial. In the example used, the scale has been calibrated for 30 heart beats. So to use it, the wearer would search for a pulse and start the chronograph. The chronograph would be stopped once 30 pulses have been counted and the pulsometer scale would then indicate the heart rate. Hence, if 30 pulses were counted at 15 seconds, this means that the patient's heart rate is 120 beats per minute.



## TELEMETER

### Watch - Tag Heuer Carrera Telemeter Cal. 18

The telemeter scale is an interesting one that was designed for use during war. It is usually found either on the outer side of the dial or towards the center and is often calibrated for 20 kilometers. It was used in World War I to help officers determine how far away the enemy artillery was. When an officer saw the flash of artillery fire, he or she would start the chronograph and stop it again when the sound of the fire was heard. Reading off the scale would tell indicate the distance of the firing enemy artillery. It can also be used to tell how far away a lightning strike is and just about any other event that can be both seen and heard. This all works because speed of sound in air is relatively constant.





# IN THE PURSUIT OF RESOLUTION

A quick guide to High Resolution Audio and what you need to fully take advantage of it.

by Marcus Wong

## THE BETTER TO HEAR YOU WITH

When we talk about digital audio recordings, the two main things that affect quality are the sampling rate and the bit depth used.

To understand how sampling rate affects the quality of music, think of someone trying to paint a picture. The sampling rate is the equivalent of the number of strokes the painter has. So, the higher the sampling rate, the more strokes he has, and hence the more accurately he can paint.

Or in this case, the more accurate the sound you hear will be. CDs use a 44.1kHz sample rate, but today's digital audio recordings can be easily found in 96kHz and 192kHz or higher. So how much information does that capture?

Well, the typical CD sample rate of 44.1kHz can capture all frequencies below 22.05kHz – just over the generally accepted range of human hearing, which is listed as 20kHz. But the other reason why 44.1kHz was chosen was because at the time that the standard was set, storage was expensive, and a sampling rate above 44.1kHz would have meant less playing time than the just about adequate 74 minutes most audio CDs could provide.

Given that storage is immensely cheaper these days, a jump to twice the sample rate of 88.2kHz or 96kHz should be more than an adequate balance between storage space and accuracy. Hence the reason why HRA tracks are generally found with sampling rates at 96kHz and above.



By now I'm sure you've heard all about High Resolution Audio (HRA) and you probably fall in either one of two camps.

You have the group who insist that HRA is nothing more than marketing spiel fabricated so music companies have a new way to charge a new premium, especially when most consumer audio equipment cannot possibly deliver the benefits of HRA.

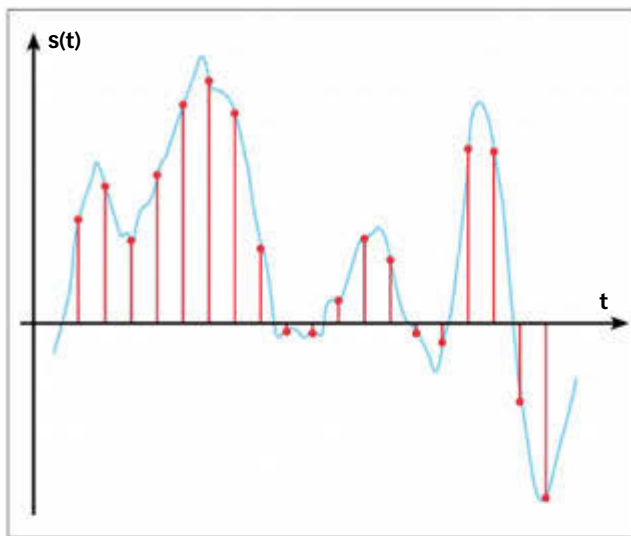
And then, there's the group that truly believes that you haven't heard music until you've heard it in HRA. This group truly feels like there's an audible, quantifiable difference between a normal track and one recorded in full high resolution, and that you haven't quite heard music until you've heard it in true high resolution. Both groups are right, and here's why.

## A NUMBERS GAME

Bit rate is what's commonly used to explain why HRA is better, the basic reasoning being that the more bits you have to describe a sound with, the more accurately you can do so.

Every bit added reduces the errors made in conversion from analog to digital; errors that manifest themselves as noise and distortion. So logically speaking, a well-recorded 24-bit audio clip should be able to reduce the distortion to well below what the human ear can hear.

However, those extra bits of information also need more computing power to store and process accurately and John Siau of Benchmark Media Systems estimates that a 24-bit system needs 256 times the accuracy of a 16-bit system in order to make full use of the additional 8 bits, so it certainly will take a high-end system to properly render all the extra bits in a meaningful way.



The greater the sampling rate, the smoother the curve will be.

## BOTTLENECK: HARDWARE

Every element in the chain of an audio system brings with it an added element of noise and distortion. Audiophile-grade equipment has better components and the processing required to minimize these issues in order to bring out the best audio experience possible.

This is the reason why you probably can't hear any difference between HRA or SRA tracks on your portable media player or smartphone, even though it supports the playback of HRA formats.

# SPRUCING UP REALITY

by Koh Wanzi

Let's face it, reality is boring. But what if things could be different? Microsoft's HoloLens may be making the headlines, but we're guessing you don't have one just yet. Here are some apps that can help season your experience of the real world with some digital spice.

## WIKITUDE

iOS, Android  
Free



Wikitude helps you experience the real world through a rich body of digital information.

Say you're hungry and feel like munching on a good T-bone steak. Simply search for steakhouses in the app and fire up your smartphone camera to scan the world around you. A digital overlay will tell you when there are any nearby matches. You can also easily parse the world around you into categories, allowing you to narrow or widen your search of your surroundings accordingly. In addition, Wikitude comes with image recognition tools that enable you to access enhanced digital content like animations and videos embedded in print ads and packaging.



Wikitude's digital overlay allows you to discover more about the world around you.

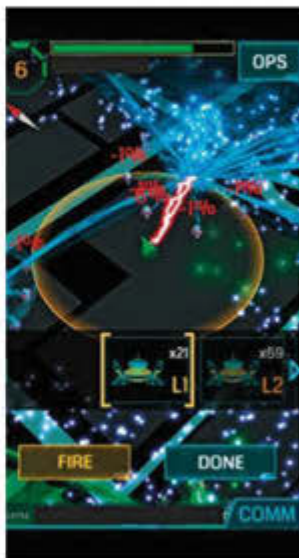
## INGRESS

iOS, Android  
Free



You don't have to wait for Magic Leap to experience gaming in augmented reality.

Ingress is a massively multiplayer online augmented reality game that turns the real world into your virtual playground. The game has all the right elements to whet your appetite for grand battles and science fiction. Players can align themselves with either the Enlightened or the Resistance as they fight for control of a mysterious energy source called Exotic Matter (XM). In the Ingress universe, real world locations become battlefields as players fight to collect XM and gain control of portals around buildings and landmarks to advance their cause.



Ingress turns the real world into a virtual battlefield as you choose a side and battle for control.



## STAR WALK 2

iOS, Android  
Free, \$3.36 (Premium)



Reality often means keeping your feet firmly grounded to the earth. So it's only fitting that the

Star Walk 2 augmented reality app lets you turn your gaze to the heavens. As you hold your phone up towards to the sky, Star Walk 2 uses your phone's built-in gyroscope to match the map on your screen to the stars. To find a particular star, constellation or planet, simply tap 'Search' and the app will point your gaze in the right direction. Star Walk 2 also assigns coordinates to constellations and other celestial objects, allowing you to abandon your earth-bound perspective and view objects from any vantage point in space.



With a comprehensive database, you can assign names to celestial objects and explore them from multiple perspectives.

## THEODOLITE

iOS  
\$4.98



Digital photography is great, but we've all wished at one point or another to be

able to glean more information about our surroundings through a viewfinder. Theodolite is a multi-function viewfinder that combines a compass, two-axis inclinometer, rangefinder, GPS, navigational calculator and more into a single app. The digital overlay is capable of displaying detailed information like angle of elevation, altitude and display location in several different coordinate formats. The app also has collaborative functions – you can share your location with up to 20 people on Theodolite's map – making it perfect for group trips.



Adds a digital overlay to your camera's viewfinder to display information like compass direction and coordinates.



Of all the classic iPods, the iPod nano probably has the best balance of design and portability. The model shown here is the 2nd Gen Product Red special edition released in October 2006.





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# TAKE CON7ROL

CHAMPIONS KNOW NO FEAR

*ss*

JEREMY LEE

Action Images, a Reuters company



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